BUREAU OF HYGIENE AND TROPICAL DISEASES

TROPICAL DISEASES BULLETIN

Vol. 55] 1958 [No. 5

SUMMARY OF RECENT ABSTRACTS *

IV. TRYPANOSOMIASIS †

African Trypanosomiasis

General: Reports: Epidemiology

Muriel Robertson (p. 135), in a Manson Lecture, gives an account of the work of Bruce on trypanosomiasis, which forms a historical background to the subject.

The annual report of the British Tsetse Fly and Trypanosomiasis Committee for 1955–56 (p. 928) sums up work done on both human and animal disease. Details must be sought in the original, but it may be mentioned that though new trypanocidal drugs for animal disease seem to have opened a new phase, work on arboricides and herbicides has been disappointing. Dieldrin may be more useful than DDT against tsetse flies.

The report for 1955–56 of the East African Trypanosomiasis Research Organization (p. 1261) records work on the food and the resting sites of tsetse flies, their reactions to humidity, and their sense organs. There has been much work on trypanosomes (the Tinde strain of *Trypanosoma rhodesiense* was still infective for man after 21 years in sheep and *Glossina morsitans*) including studies of development in the flies, and the effect of cortisone on infections in animals. Epidemiological research and studies in biochemistry, immunology (in cattle), chemotherapy and reclamation are reported, and these should be read in full.

The annual report of the West African Institute for Trypanosomiasis

* The information from which this series of summaries has been compiled is given in the abstracts which have appeared in the *Tropical Diseases Bulletin*, 1957, v. 55. References to the abstracts are given under the names of the authors quoted and the pages on which the abstracts are printed.

† For previous articles on trypanosomiasis in this series, see the May issues of the *Tropical Diseases Bulletin* each year since 1939.

Research for 1955 (p. 132) contains accounts of work on erythrocyte sedimentation, the numbers of trypanosomes in the organs of infected rats, trials of Melarsen in treatment and of suramin in conjunction with pentamidine and other drugs (whose toxicity it reduces), work on *T. vivax*, and on the control of the insect vectors of trypanosomes. It should be read in full.

The annual report of the Sleeping Sickness Service of Northern Nigeria for 1956 (p. 1162) states that the incidence of 0·15% found was the lowest on record. Chemoprophylaxis with pentamidine is employed, apparently with effect. Information is given on treatment with Melarsen to overcome tryparsamide resistance, and on tsetse control.

In the annual report of the Trypanosomiasis Commission of Mozambique for 1954 (p. 1028) the distribution of tsetse flies is shown. There was no alteration in the distribution of sleeping sickness. Pentamidine was used in prophylaxis, and control of tsetse was attempted by the slaughter of game, capture of flies and clearing of bush. The commonest fly was *G. morsitans*.

Trypanosomiasis in Ruanda-Urundi has already been attributed to *T. rhodesiense*, and EVENS (p. 136), after making a study of the strains, confirms this view. The disease was probably introduced from Tanganyika, and spread among a sedentary population by *G. morsitans*; this form is now reported from the Congo for the first time.

In Portuguese Guinea 469,727 Africans were examined in 1955 and PINTO (p. 404) reports that 1,328 cases of sleeping sickness were found.

Aetiology

HOARE (p. 1061) discusses the spread of African trypanosomes beyond their natural range. *T. vivax* is transmitted by tsetse flies but it can break its bounds when mechanically spread by horse-flies, and in this way it has passed to America. *T. evansi* probably originated from *T. brucei* infecting camels, and became adapted to transmission by other biting flies; it lost its polymorphic characters and transmissibility by tsetse flies, and spread from camels to other domestic animals, reaching the Far East and America.

REICHENOW (p. 1300) traces the development of blood parasitism in mammalian trypanosomes, taking *T. rangeli* and *T. conorhini* as examples, both of which are primarily parasites of triatomid bugs. They were able to establish themselves precariously in vertebrate hosts, but they do not multiply in the blood. Other trypanosomes (*e.g.*, *T. cruzi*) are unable to multiply in the blood of the host, but do so in the tissues. Others like *T. lewisi* reproduce discontinuously in the crithidial stage in the blood, and others (the pathogenic African trypanosomes) do so continuously. Finally, some, like *T. evansi*, become emancipated from their intermediate hosts and are transmitted mechanically.

In experiments with a strain of trypanosome which had accidentally caused infection in man, WILLETT (p. 137) found that the infective

dose for man, in infected rat blood, was 20,000 and 80,000, and this dose could be given accidentally from a contaminated syringe (as probably happened in one case). There is a constant interval (mean 2·6 days) between the onset of a reaction at the site of inoculation and the first appearance of trypanosomes in the blood, and possibly a critical period within which an infection becomes established, depending either on the trypanosomes or the host resistance. *G. pallidipes* ejects much larger numbers of metacyclic trypanosomes than *G. morsitans*, and the author suggests that this larger dosage might lead to progressive reduction of the incubation period and increase in virulence of the trypanosome when transmitted by *G. pallidipes*.

WILLETT (p. 656) discusses the relationships of *T. rhodesiense*, *T. gambiense* and *T. brucei*. The distinguishing characters are chiefly virulence, posterior nuclear forms, response to arsenicals and to the trypanocidal action of human serum, and most strains are fairly clear-cut, though some are intermediate. But the most constant distinguishing feature between Gambian and Rhodesian sleeping sickness is that the Gambian form occurs in *G. palpalis*-group areas and the Rhodesian form in *G. morsitans*-group areas. The species of trypanosome seems to be determined by the vector. Moreover, the higher the dose of metacyclic trypanosomes injected, the shorter the incubation period, and *G. pallidipes* injects more than *G. morsitans* and *G. swynnertoni*, and these more than *G. palpalis*. Hence virulence is increased by transmission through the *morsitans* group. *T. rhodesiense* may have arisen in this way from *T. gambiense* by transmission through *G. pallidipes*. *T. brucei* is apparently not transformed into *T. rhodesiense*, but *T. rhodesiense* retains infectivity to man after prolonged cyclical passage in ruminants, and there is strong circumstantial evidence that the Rhodesian disease is a zoonosis, with game animals as reservoir hosts.

It is known that most of the metacyclic forms of *T. brucei* disperse within 20 hours of an infective bite and that no multiplication takes place at the site of entry. GORDON and WILLETT (p. 270) now show that tissues from the site of the bite are always negative for trypanosomes between 5 minutes and 24 hours after the bite, and that heart blood is often positive at that time. Metacyclic forms, therefore, are rapidly carried away and develop into blood forms, which persist and are infective throughout the incubation period.

The question of sexuality in *T. gambiense* was investigated by AMREIN (p. 1060) who rendered 2 strains resistant to suramin and tryparsamide respectively, *in vitro*, and then mixed and grew them together in media with and without these drugs. The strains could be re-isolated, and retained their characters, which indicates that neither genetic exchange nor transmission of resistance between them had taken place, which is evidence against sexuality *in vitro*, but does not exclude it in the blood forms.

MOLINARI and MONTÉZIN (pp. 405, 536) exposed various trypanosomes to a temperature of −180°C. and −79°C. for different periods. After −180°C. for 1 hour *T. brucei*, *T. congolense* and *T. evansi* remained infective for rodents, but *T. cruzi* and *T. gambiense* were not infective. Both mobility and virulence of *T. cruzi* disappeared after 5 minutes at −180°C.

In East Africa a strain of *T. rhodesiense*, passaged through *G. morsitans* and sheep for 18½ years, remained infective for man. By experiment on himself FAIRBAIRN (p. 400) showed that another line of this strain, passaged in London through rodents by syringe, had apparently become non-pathogenic for man. It was monomorphic in rats, in the sense that stumpy forms were absent. A syringe-transmitted strain of *T. gambiense*, however, did accidentally infect man, and in this also the stumpy forms were absent. He concludes that stumpy forms are not essential for infection, which depends on slender or intermediate forms, and the lengths of these, in the strain examined, were equal to or greater than those of the corresponding forms of a cyclically transmitted strain.

JENKINS and GRAINGE (p. 136) compared the oxidative metabolism of an old laboratory strain of *T. rhodesiense*, which had become monomorphic and had lost its pathogenicity for man and guineapig and did not infect *G. morsitans*, with that of a freshly isolated strain. The mean oxygen uptake of the old strain was greater than that of the new. FULTON and SPOONER (p. 930) have confirmed earlier work which suggested that the respiration and mobility of *T. rhodesiense* are inhibited by thiol compounds in the absence of red cells, and that this inhibition is produced by hydrogen peroxide formed in the oxidation of the thiol compounds. In suspensions the peroxide is destroyed, not by catalase, but by metabolic products, probably pyruvic acid. *T. rhodesiense* obtains its energy by catabolism of glucose, and requires a great deal. GRANT and FULTON (p. 1163) describe the processes involved.

VAN BOGAERT and DUBOIS (p. 796) found that one strain of *T. gambiense* produced in Syrian hamsters cerebral lesions closely resembling those which occur in man; this animal is therefore useful in the study of the disease, but it is difficult to make repeated blood films from it.

In mice inoculated with relapse strains of *T. gambiense*, followed by human serum, the succeeding relapse strain became identical with the original (initial) strain, and the phenomenon represented a reversal which INOKI *et al.* (p. 656) regards as due to direct action on the trypanosomes, and not to selection of mutants.

FROMENTIN (p. 15) has already shown that infection with *T. gambiense* in the rat is intensified by treatment with sodium salicylate. He now shows that this is also true of various derivatives of that acid, but with the *p*-amino derivative (PAS) and in controls the blood of the infected animals became negative in about 7 days. The animals receiving the other derivatives died.

Transmission

GÂNDARA (p. 626) collected *G. p. palpalis*, "*G. fuscipes quanzensis*", *G. schwetzi* and *G. morsitans* in Angola.

FAIRBAIRN and WILLIAMSON (p. 268) and WILLIAMSON (p. 269) describe the composition of the saliva of various species of *Glossina*, giving an account of a histochemical analysis and an analysis of amino acids and sugars. The object was to find the nature of the salivary constituents which are altered or disappear during the development of crithidial forms and metacyclic trypanosomes, and which are therefore presumably used by the trypanosomes.

The process of feeding has been followed by direct microscopic observation of the mouthparts of *G. morsitans* when actually in the tissues of the bitten animal; GORDON *et al.* (p. 544) have developed a special apparatus for this purpose. The fly pierces the skin with a cutting movement of the labella, and then probes until it lacerates a capillary satisfactorily, when it sucks up the blood as rapidly as it flows out. Saliva is repeatedly ejected during the whole process.

WEITZ and GLASGOW (p. 400) report the results of a combination of the precipitin test and an inhibition test for examination of blood meals of 1500 tsetse flies (mostly *G. morsitans*) in East Africa; the test is new and delicate. Suidae provided the food for many of the flies, and various bovids were rather less popular; monkey blood was found occasionally, but never zebra. Much more detailed information is given in the original abstract; the work is important. GLASGOW (p. 657) makes the point that man is not the preferred host of any species of *Glossina*, and after discussing the identification of blood meals of various East African species he indicates that warthog is preferred, though the flies can maintain themselves on other hosts. Destruction of the apparent preferred host, therefore, is not a method of tsetse control. VAN DEN BERGHE and LAMBRECHT (p. 139) tested 61 *G. morsitans* to identify the source of their blood meals; they also found that warthog was the favoured host, but the blood of many other animals was also found.

BURSELL (p. 930) notes that branched hairs guarding the aperture of the thoracic spiracles are the sense organs by which humidity changes are perceived by tsetse flies. *G. morsitans* is more active in dry air than in moist, and this is also true of some other species tested. In still air a fly may maintain about itself a high humidity which will induce resting, but if the water lost is dissipated rapidly the dry air will stimulate activity. He (p. 1393) shows that if the spiracles are put out of action the rate of water loss in teneral *G. morsitans* is a linear function of humidity. In nature, however, there is some degree of closure of the spiracles which is correlated with atmospheric humidity and with the water content of the fly itself. Attempts were made to discover the sense organs responsible for the integration of water content and atmospheric humidity with closure of the spiracles, but no conclusions could be drawn.

Older *G. palpalis fuscipes* are much more susceptible to cold than young

flies, which are hardly harmed by temperatures of 1·5°–10°C. Similar tendencies were observed with other species, and BURNETT (p. 1294) observes that the use of chilling cannot be recommended for experiments which depend on normal survival and behaviour of flies after release.

VAN DEN BERGHE and LAMBRECHT (p. 139) describe 4 different kinds of vegetation with which *G. pallidipes* is associated.

JEWELL (p. 138) uses a special set of non-toxic dyes which fluoresce in ultra-violet light for marking tsetse flies.

Clinical Findings

GALL (p. 931) remarks that little is yet known of the mechanism by which trypanosomes invade the tissues or cause symptoms. He discusses the nature and function of the increase in serum gamma globulin which takes place in the disease. GALL *et al.* (p. 1295) found very high erythrocyte sedimentation rates in *T. gambiense* infection, in association with marked blood-protein changes. The sedimentation rate falls as the disease progresses, and during treatment. The increase in the rate is closely associated with the clumping of red cells which is evident in trypanosomiasis, and this is also associated with a very high level of serum gamma globulin. The sedimentation rate affords a rough indication of the gamma globulin response to the infection.

DEPOUX *et al.* (p. 539) developed a complement-fixation test for trypanosomiasis in which the antigen was prepared from *T. equiperdum*, and they found it positive in cases in which trypanosomes were present but negative in controls and cured patients. There was no correlation between titre and the clinical state or the presence of trypanosomes. In late cases the test may become negative before clinical cure, but in relapse it becomes positive again. It may be useful in detecting infection in a person in whom prophylactic pentamidine has made it difficult to demonstrate a trypanosome.

GALLAIS *et al.* (p. 140) used pneumo-encephalography to study the effect of trypanosomiasis on the brain; details should be sought in the original. VAN BOGAERT (p. 931) discusses in general terms the neurological changes which take place in sleeping sickness.

In describing the form of trypanosomiasis seen in fishermen at Lake Tumba, Belgian Congo, VAN DEN BERGHE (p. 135) notes that the rate of salivary gland infection with trypanosomes in *G. palpalis fuscipes* is high (5–14% according to season) but that cases of the disease are rare and mild. This seems to be an instance of Gambian sleeping sickness of low pathogenicity in an exceptionally well nourished and healthy population.

COLLOMB *et al.* (p. 655) report a number of Africans in whom trypanosomiasis was found up to 4 years after they had left the endemic area; most of them were showing signs of the disease for the first time. The delay in the appearance of the manifestations is discussed, and their appearance could possibly be attributed to bacterial or virus infections, fatigue, malnutrition or other factors disturbing host-parasite relationships.

Treatment

BUTLER *et al.* (p. 540) in West Africa have used Melarsen for *T. gambiense* infections, observing 244 patients for 2 years. They conclude that it is considerably more effective than tryparsamide for advanced cases, but when high dosage is used the drug should be given only under medical supervision. Mel B is Melarsen oxide with BAL. It has been used by APTED (p. 541) in many *T. rhodesiense* infections, and he reports favourably on it for advanced cases. If the dosage is carefully regulated this drug affords a most valuable and safe treatment, and if proper attention is paid to the patient's condition toxicity is not a serious problem.

LEGRAND *et al.* (p. 658) describe a child in Léopoldville with trypanosomiasis, who showed few clinical signs in spite of heavy infection of the cerebrospinal fluid. Local infections are somewhat resistant to tryparsamide, so the authors gave Arsobal, with good results.

PACKCHANIAN (p. 1164) describes the action of Captostibone, an antimony compound, on *T. gambiense* and *T. rhodesiense* in laboratory animals; it has some value, but in comment Hawking remarks that many other more active compounds are known. It has been used in human leishmaniasis.

From experiments with *T. rhodesiense* and stilbamidine FULTON and GRANT (p. 542) conclude that when the trypanosomes are exposed to the drug *in vitro* some or all of them take up a lethal quantity. If injected into animals the trypanosomes die but stimulate an immune response. The drug acts directly on the trypanosomes, and there is no evidence of the production of a more active metabolite in the tissues of the host.

AUSTIN *et al.* (p. 545) describe a new compound, decamethylene *bis* (*iso*-quinolinium bromide), which is active against *T. congolense* and *T. vivax*.

Puromycin [Stylomycin] is reported to be therapeutically active against *T. gambiense* in man, and experimental work suggests that it and its amino nucleoside interfere with purine metabolism. TOBIE and HIGHMAN (p. 141) report on the action of this amino nucleoside in various trypanosome infections of experimental animals. Details should be sought in the original. TRINCÃO *et al.* (pp. 270, 271) found Stylomycin active against *T. gambiense* at a concentration of 2 μgm. per ml., and they report that 10 of 15 patients treated with this antibiotic, and observed for 25 months, were free from parasites. In a few patients the cerebrospinal fluid, which was abnormal, had become normal. In experiments with a freshly isolated strain of *T. rhodesiense* maintained cyclically in guineapigs and thence by syringe in rats, however, BAKER (p. 797) found only poor results with Stylomycin, and concludes that this antibiotic is not likely to be useful in human infections.

A definite curative action in mice against *T. gambiense* and especially *T. rhodesiense* is reported by PACKCHANIAN (p. 542) for the antibiotic

Amphomycin. The same quantity is more effective when spread over several days than when given as a single dose.

Control

For the control of *G. morsitans* in part of Ruanda Urundi VAN DEN BERGHE and LAMBRECHT (p. 141) propose selective clearing in which only acacias over 4 metres in height would be felled. The plan is based on the method used with success in Ankole, Uganda, and in Tanganyika.

Obstructive clearing means the felling of riverine trees to block with trash the stream bed and obstruct the line of flight of *G. palpalis*; the dense riverine thickets are left uncut. NASH and STEINER (p. 1394) show that in this way eradication can be achieved, in isolated stretches, in as short a time as 3 months. The method is relatively cheap, but it is useful for large-scale projects only. The alteration in habitat causes increased hunger in the flies, partly, it is thought, by blocking their free flight under the shade in search of food, and partly by producing conditions distasteful to the creatures on which they feed.

For the control of *G. pallidipes* and *G. palpalis* FRYER *et al.* (p. 1395) tried a chemical defoliant sprayed on a large scale from the air; this resulted in rapid defoliation of most of the leafy plants, many of which died. There was no significant effect on the flies during the first 9 months, but then an accidental fire occurred and *G. pallidipes* was at once greatly reduced, though *G. palpalis* was hardly affected.

HOCKING and YEO (p. 543) have continued the application of DDT or BHC from aircraft for the control of tsetse flies in East Africa. In one experiment *G. morsitans* was reduced by 95%, but immigration of flies caused a rapid increase in their numbers. In another and more isolated area *G. morsitans* was reduced to 0·05% and *G. pallidipes* was eliminated. In experiments with DDT and dieldrin applied to vegetation along a river BURNETT *et al.* (p. 1296) found that DDT was lost much more rapidly than dieldrin, especially in high wind which dislodged the crystals. If DDT is applied at short intervals and remains lethal for 2–3 days it may be enough to kill nearly all the flies, but on the whole 1 application of 5% dieldrin seems to be as effective as 2 of 1·7% dieldrin or 4 of 5% DDT 2 weeks apart. The insecticides were applied at the rate of 15 gallons per mile of river bank. HYDE-WYATT (p. 1296) used DDT against tsetse flies in a garden covering 5 acres in Ghana, where other control was not possible. The results were good, and in such conditions DDT seems to be satisfactory and safe.

AMERICAN TRYPANOSOMIASIS

General: Transmission

A survey of Chagas's disease in Paraíba, Brazil, is reported by DA SILVA *et al.* (p. 1299), who remark that the incidence is sporadic on the coast,

but important in some inland areas, with infection rates up to 12·4%. Only a few cases of Chagas's disease have been reported from French Guiana; FLOCH and BOULAN (p. 935) describe 2 new cases.

In the Amazon region of the State of Goiaz, Brazil, the chief vector of *T. cruzi* is *Panstrongylus megistus* with an infection index of 5·9%, and the index for *Triatoma sordida* is 0·31%. In a study of the monthly variation in the incidence of developing forms of *Triatoma infestans* and *Panstrongylus megistus* in part of Brazil DIAS (p. 144) found that late nymphs and adults of *T. infestans* predominate in the dry and cool season, and adult and larval *P. megistus* in the wet and hot season. The main incidence of Chagas's disease is concurrent with the latter. DIAS and ZELEDÓN (p. 145) describe a small hut which was found to be infested with several thousand *T. infestans*, which showed 37·7% infection with *T. cruzi*. All the 6 persons living in it gave positive complement-fixation reactions for *T. cruzi*, and 4 gave positive xenodiagnoses.

JÖRG (p. 798) indicates the southern limit of distribution of *T. infestans*, and of *T. infestans* infected with *T. cruzi*, in Argentina.

HALFF (p. 145) investigated the symbiont gut flora of *T. infestans*; folic acid was the main constituent produced by the symbionts.

In part of Peru *Panstrongylus herreri* is the only proved vector of *T. cruzi*; HERRER (p. 271) found infection in 31·4% of these bugs.

GEIGY (p. 934) has resected certain nerves or ganglia of *Rhodnius prolixus* to study the modifications induced in the feeding process, and has deduced a scheme of probable neuro-physiological inter-relationships. The frequency of defaecation of Triatomid bugs during feeding is a factor of great epidemiological importance in Chagas's disease. DIAS (p. 272) observed that it increased in the order nymphs, males, females for any one species, and that of the species examined. *Rhodnius prolixus* was the most significant in this respect.

An apparatus for the feeding of Triatomid bugs is described by JACQUEMIN (p. 272); details must be sought in the original. PICK (p. 1165) describes an apparatus for the feeding of triatomids so as to collect faeces for determining metacyclic *T. cruzi*. Triatomid bugs tend to bite about the face in human beings, but experiments by PICK (p. 1166) suggest that this is merely a matter of accessibility of the face in people lying in bed, not of preference for that over other parts of the body.

Aetiology

T. cruzi can be transmitted in transfused blood, and positive complement-fixation reactions have been found in blood for transfusion tested in São Paulo. NUSSENZWEIG *et al.* (p. 146) added 25 ml. of 0·5% solution of gentian violet per 500 ml. of blood (which gave positive complement-fixation reaction) 24 hours before transfusion, and no patient receiving this blood became infected. The results were promising, but more work is needed.

ROMAÑA (p. 547) gives an account of the life cycle of *T. cruzi* in tissues and blood. The details should be read in full for clear understanding. A description of the behaviour of *T. cruzi* and *T. rangeli* in culture is given by ZAMORANI (p. 406). GARNHAM (p. 547) isolated a new strain (" Sonya ") of *T. cruzi* in Brazil, and describes its characters; it is now maintained in mice in London.

A detailed study is reported by INES SILVA (p. 405) of the lytic action of serum of normal animals (including man) on *T. cruzi* in culture media. The degree of lysis differed with different persons, and with the same person at different times. This long monograph contains descriptions of media and information on the cultivation of *T. cruzi*. Similarly, RUBIO (p. 1299) shows that when *T. cruzi* from cultures or blood was exposed to sera from man and several animals, the crithidial culture forms were lysed by all except murine sera. The lytic principle was destroyed by standing for a long time or by heating.

Working on the effect of cortisone on experimental *T. cruzi* infection, PIZZI and CHEMKE (p. 1063) found that high doses intensified the disease, with reduced inflammatory reaction. This effect may have been due to acceleration of reproduction of *T. cruzi*, or inhibition of inflammatory reaction or of phagocytic activity, or lowering of the titres of " non-lytic " antibodies.

Immunity: Clinical Findings: Control

PIZZI (p. 1396) has written a monograph on the immunology of Chagas's disease. He has already shown that cellular factors are almost exclusively responsible for the development of immunity, and that the parasites are destroyed by phagocytes. There is an apparent paradox in that in the course of acquiring immunity the same macrophages which harbour the parasites as host cells undergo changes which transform them into phagocytes which destroy the parasites.

For the complement-fixation test in Chagas's disease CHAFFEE *et al.* (p. 548) use an antigen prepared by extraction from desiccated trypanosomes. The technique of preparation is described. The test was positive in 98% of sera in Chagas's disease and 19% in leishmaniasis, but not in normal or syphilitic controls. A precipitin test with a polysaccharide fraction isolated from culture forms of *T. cruzi* was used with success by PELLEGRINO *et al.* (p. 1300), who regard it as important as an auxiliary method of diagnosis.

In acute Chagas's disease the heart lesions are essentially those of acute myocarditis, but in mild cases this condition may not easily be detected. LARANJA *et al.* (p. 660) discuss the electrocardiographic changes which take place. In chronic disease myocardial damage is common, but the disease may otherwise be symptomless, and the authors discuss the type of heart disease encountered and methods of diagnosis. No drug has been found entirely effective. SCHENONE and NIEDMANN (pp. 1064, 1300) compared the clinical and electrocardiographic findings in chronic Chagas's

disease and compared them with findings in normal persons. There was some indication that the infected persons showed greater cardiac disability than the controls, but on the whole the disease was benign. In Venezuela myocarditis is common. BERNING (p. 1397) discusses a series of cases, and in considering the possible aetiological factors shows that there is little doubt that Chagas's disease is the cause.

KÖBERLE and NADOR (p. 147) describe *mal de engasgo*—dilatation of the oesophagus—which is one of the results of Chagas's disease in Brazil. In a discussion of the dilatation of hollow muscular organs (the "megas") which occur in Chagas's disease KÖBERLE (p. 935) states that the principal factor is the destruction of the nervous tissue of the muscular wall, leading to hypertrophy and hypertony of the wall; this phase goes on to enlargement and complete atony of the organ. In mice the muscle layers and serous membrane of the stomach are involved in *T. cruzi* infection, and LESSER and LUKEMAN (p. 936) suggest that unexplained human gastric disturbances in the endemic areas may be due to this cause.

PACKCHANIAN (p 663) has found that certain nitrofuranes had some limited value in experimental *T. cruzi* infection.

PINOTTI (p. 936) describes the campaign against Chagas's disease in Brazil; BHC is the insecticide commonly used for control.

T. rangeli

Development of developmental forms of *T. rangeli* have been found by ZELEDÓN (p. 147) in *Rhodnius prolixus*, and *T. rangeli*, in contrast to *T. cruzi*, was found by GREWAL (p. 937) to be pathogenic to *R. prolixus* and *Cimex lectularius*. *Charles Wilcocks*

MALARIA

In this section abstracts are arranged as far as possible in the following order:—Human malaria—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control;* Animal malaria—*monkeys, other animals, birds.*

MUIRHEAD-THOMSON, R. C. **Notes on the Characters of *P. malariae* Oöcysts of Possible Value in Mixed Infections.** *Amer. J. Trop. Med. & Hyg.* 1957, Nov., v. 6, No. 6, 980–86, 21 figs. on pl. & 1 chart.

Following the work of SHUTE and MARYON [this *Bulletin*, 1952, v. 49, 358, 1095; 1955, v. 52, 244] on the oöcyst of *Plasmodium malariae* in *Anopheles maculipennis atroparvus*, the author describes a comparable study with *A. gambiae*. Mosquitoes were fed on likely subjects and then maintained at 27°–28°C. Periodic examination of the stomachs confirmed the slower development of *P. malariae* (the cysts being half-grown on the 7th–8th day) as compared with *P. falciparum*, but a more rapid

development than that seen by Shute and Maryon, probably owing to the lower incubation temperature of these workers.

The oöcyst pigment characteristics of *P. malariae* are figured and described and compared with those of *P. falciparum*. Variation in the oöcysts of *P. falciparum* were found, however, which overlapped with *P. malariae*, particularly in early stages, and could well make identification difficult in an infection of unknown age. A suggestion is made that wild-caught mosquitoes might be kept 8–9 days before dissection; this would allow *P. falciparum* oöcysts to reach maturity whereas any *P. malariae* oöcysts resulting from infection shortly before capture would be immature and show *malariae* type of pigment. *E. R. Nye*

MUIRHEAD-THOMSON, R. C. **The Malarial Infectivity of an African Village Population to Mosquitoes** (*Anopheles gambiae*). **A Random Xenodiagnostic Survey.** *Amer. J. Trop. Med. & Hyg.* 1957, Nov., v. 6, No. 6, 971–9. [13 refs.]

The low correlation between gametocyte density in the peripheral blood and actual infectivity, with particular reference to *Plasmodium falciparum*, is emphasized [this *Bulletin*, 1955, v. 52, 740; 1956, v. 53, 710]. An approach to the problem by feeding laboratory-reared *Anopheles gambiae* on the local African population (Liberia) and subsequently examining for oöcyst development without reference to the blood picture is discussed.

A random group of people, totalling 347, was taken and up to about 50 *A. gambiae* fed on each. 32 were found infective. The infective subjects in the age-groups 0–4 years, 5–14 years, 15 years and over were determined and the percentage infectivity rate for the population as a whole was calculated to be 4·2%, 3·0% and 3·3% respectively in the above age-groups. The small percentage of mosquitoes infected by the "positive" cases is noted and the comment made that it is the number of mosquitoes infected rather than the number of oöcysts produced that is important epidemiologically. In this study the number of oöcysts in the infected mosquitoes was also small and the point is made that it is the subjects with low infectivity rate who, taking the figures as a whole, infect the majority of mosquitoes. *E. R. Nye*

HOUEL, G. Note sur l'orientation trophique d'*A. labranchiae* au Maroc. [**Feeding Preferences of** *Anopheles maculipennis labranchiae* **in Morocco**] *Bull. Inst. Hyg. Maroc.* 1955, v. 15, Nos. 3/4, 201–8.

Anopheles maculipennis labranchiae is the principal vector of malaria in Morocco. The results of precipitin reaction tests of the blood meals of 1,497 females, captured in different types of resting place, are set out in 5 tables, and show that most of the meals (84%) were obtained from animals other than man. Most of the meals were from cattle (52%), and

the same result was obtained with mosquitoes resting in houses and tents, in stables and pigsties, and in uninhabited resting places, such as caves and silos. Some (15%) of the 88 mosquitoes collected in "uninhabited" places had fed on human blood. There was little difference in the composition of the blood meals taken in an area treated with insecticide for 5 years, and in an untreated area, except that the origin of a much larger proportion of the blood meals in the untreated area could not be identified.

B. R. Laurence

Senevet, G., Andarelli, L., Duzer, A. & Lieutaud, A. Gîtes à *Anopheles multicolor* Cambouliu dans le Tell algérien. IV. [**Breeding Places of *Anopheles multicolor* in the Algerian Tell**] *Arch. Inst. Pasteur d'Algérie.* 1957, Sept., v. 35, No. 3, 296–300, 1 fig.

Misra, B. G. & Ray, A. P. **Detection of Malaria Parasites by Concentration Method.** *Indian J. Malariology.* 1957, Sept., v. 11, No. 3, 249–51. [10 refs.]

Use has been made of thick films in the diagnosis of malaria for many years. Concentration methods have likewise proved useful [this *Bulletin*, 1938, v. 35, 709; 1940, v. 37, 864; 1947, v. 44, 17]. The authors have used the last method to compare its value with that of the thick film method. A total of 100 *Macacus rhesus* monkeys were inoculated with equal numbers of *P. knowlesi*, *P. cynomolgi* or *P. inui*, and 0·5 ml. blood was taken from the animals 4 hours after infection and on each subsequent day. It was mixed with 10 ml. 1% acetic acid, then centrifuged at 1500 r.p.m. for 10 min. Thick and thin blood films were then made from the parasite layer. At the same time thick and thin films were made directly from the animals' blood. The number of positive results obtained by the concentration method compared with that of the direct thick film method was as 60 to 42. The parasite density by the former method was also considerably greater. The authors therefore recommend the use of the concentration method for diagnosis.

[It is not indicated in the text what were the proportions of the different plasmodia detected.]

J. D. Fulton

Hoekenga, M. T. **Propoquin in Treatment of Malaria.** *Amer. J. Trop. Med. & Hyg.* 1957, Nov., v. 6, No. 6, 987–9.

Propoquin (4-(7-chloro-4-quinolylamino)-α-1-pyrrolidyl-o-cresol dihydrochloride) is a yellow, crystalline bitter compound and is moderately soluble in water. Preliminary toxicity studies have been carried out on mice, rats, rhesus monkeys and dogs. In dogs, oral doses of 80 mgm./kgm. daily during a 3-month period were well tolerated. Prolonged high oral dosage in rats and dogs produced a high degree of vacuolation of the

liver cells and the appearance of macrophage cells with lightly acidophilic staining matter in lung, liver and lymphoid tissue.

In the present study this antimalarial was given by the mouth to 65 patients and by the intramuscular route to 120. All 185 patients were Panamanians of mixed Spanish, Indian and Negro descent. Their ages ranged from 1 to 80 years. 61% were males and 39% females and they were treated at the United Fruit Company hospital at Puerto Armuelles, not far from the Costa Rica boundary. *Anopheles albimanus* is the principal vector in this area.

The standard single intramuscular dose for adults and older children was 5·0 ml. of a 3% solution, or 150 mgm. A smaller amount, 2–4 ml., was administered to smaller children. The single oral dose given to adults and older children was 4 capsules or 600 mgm.; a smaller amount of 1 to 3 capsules sufficed for younger children. With both methods of administration there was such rapid improvement that it was possible to discharge all patients, usually within one or two days after treatment with a single dose.

There were no immediate failures, though gametocytes persisted occasionally. In a table it is shown that the temperature became normal in 27 hours in *P. falciparum* and in 12–23 hours in *P. vivax* infections and the parasites of both species disappeared in 27–33 hours. Among the *P. falciparum* group treated orally, clinical and parasitological relapse occurred in 2, after an interval of approximately three weeks. More remarkably still, among the oral *vivax* group there were no recognized relapses. 3 of the patients treated intramuscularly relapsed; 2 had *P. falciparum* infections and relapsed after 8 days; the third had a mixed infection and this reappeared in a month, but this may have been a reinfection. No evidence of toxicity was observed and in none of the 120 patients treated intramuscularly was there any local reaction. No adverse effects were noted on patients with severe malnutrition, debility, pregnancy or anaemia. *Philip Manson-Bahr*

CLYDE, D. F. **Successful Pyrimethamine Prophylaxis of Malaria in Western Tanganyika.** *East African Med. J.* 1957, Dec., v. 34, No. 12, 647–9.

In the Tanga Province of Tanganyika the author with SHUTE had found that *Plasmodium falciparum* was resistant to pyrimethamine given monthly [this *Bulletin*, 1955, v. 52, 248]. On the other hand, success was achieved with this drug in the Belgian Congo where it was given weekly [*ibid.*, 1952, v. 49, 751], fortnightly [*ibid.*, 1954, v. 51, 465] or monthly [*ibid.*, 1955, v. 52, 335]. A trial was therefore made among African schoolchildren in Nzega, Western Province, Tanganyika, which is some 200 miles from the Belgian Congo and 400 miles from Tanga.

Malaria is endemic in this district. *Plasmodium falciparum* constituted 97% of the positive blood findings. There was little decrease in the

parasite rate during the dry season; it was 46% in children aged 7 to 10 years and 41% in those aged 11 to 12.

Pyrimethamine was given weekly in a dosage of 25 mgm. for children aged 7 to 10 years and 37·5 mgm. in those aged 11 to 12. In an initial sensitivity test, 3 weekly doses were given to 93 schoolchildren whose parasite rate was 45%; one week after the third dose none of the children had asexual parasites in their blood films, but a few *P. falciparum* gametocytes remained: 8 children who had received only 2 doses were free of parasites thereafter. Evidently no parasites resistant to pyrimethamine were present initially.

The weekly treatments were continued for 9 months, a period considered sufficient for any possible resistance to appear. Two doses (not consecutive) were omitted and at various times children dropped out and new ones joined the school: 51 received the complete course and 174 were treated at various times. Some children received the drug quite irregularly: nevertheless blood films on all treated children were invariably negative for asexual parasites, and gametocytes eventually disappeared. 46 untreated children examined during the course had a parasite rate of 38%. The weekly treatment schedule and results are set out in tabular form.

In work under publication the author with Shute showed that when a similar schedule was used in the treatment of people of all ages in another village in the Tanga Province, 12 miles from the Tanga area referred to above, resistance appeared after 5 months and was widespread after 9 months. This trial differed from that in Nzega only in that schoolchildren alone were treated in Nzega.

It is evident that, unlike the experience in the Tanga Province, pyrimethamine in the dosages and frequency used was protective for schoolchildren in Nzega and that no resistance occurred in 9 months.

H. J. O'D. Burke-Gaffney

Livadas, G. **Malaria Vector Resistance to Insecticides: with particular reference to Greece.** *Riv. di Malariologia.* 1957, Dec., v. 36, Nos. 4/6, 255–68. [44 refs.]

See this *Bulletin*, 1957, v. 54, (1292).

Soeiro, A. A malária em Moçambique, com especial referência à Campanha Antimalárica numa região predominantemente urbana (Lourenço Marques) e uma região predominantemente rural (Vale do Limpopo). [**Malaria in Mozambique with special reference to Control Measures in Predominantly Urban (Lourenço Marques) and Rural (Caniçado) Areas**] *Anais Inst. Med. Trop.* Lisbon. 1956, Dec., v. 13, No. 4, 615–34, 4 folding maps & 5 graphs. English summary (6 lines).

————, Pereira, M. & Pereira, A. A luta anti-malárica em Lourenço Marques. [**Malaria Control in Lourenço Marques**] *Ibid.*,

635–69, 5 figs. on 3 pls., 8 graphs & 1 folding map. [12 refs.] English summary.

Both these papers describe in detail an antimalarial campaign around, and in the town of, Lourenço Marques, initiated in 1946 and extended up to 18 km. from the town in 1950 to protect a population of 120,000. The first paper also contains an account of a rural campaign around Caniçado since 1953. The principal vectors of malaria are *A. gambiae* and *A. funestus*, and *P. falciparum* is the commonest species of parasite throughout Mozambique. A list is given, in the second paper, of the mosquitoes of the area, with notes of the seasonal fluctuations of the principal vectors. With the use of DDT and BHC against adults and larvae the percentage of persons admitted to hospital with malaria has been reduced from over 6%, before the campaign, to less than 2% in 1954 and 1955. This reduction has been accompanied by a reduction in infection in young children, and by a decrease in the numbers of both vectors. The costs of the campaign are set out in detail in the second paper, and the annual cost per head appears to be about 6 dollars.

B. R. Laurence

RAMACHANDRA RAO, T. & BHATIA, S. C. **A Note on the Degree of Susceptibility of *A. culicifacies* to D.D.T. in some Parts of Bombay State.** *Indian J. Malariology.* 1957, Sept., v. 11, No. 3, 261–70, 3 charts.

The susceptibility of *Anopheles culicifacies* to DDT has been measured in 12 widely scattered localities in Bombay State, some unsprayed and others sprayed with DDT for 1 to 8 years. Wild-caught, blood-fed females were collected in houses and cattle sheds and tested by the WHO technique [this *Bulletin*, 1954, v. 51, 1028].

Median lethal concentrations varied between 0·24 and 0·54% with P,P'-DDT and 0·50–0·60% with the technical product. In unsprayed areas MLCs were between 0·24 and 0·38% while in sprayed areas they were between 0·41 and 0·54%.

In order to investigate the possibility that previous spraying had significantly lowered susceptibility, values of the MLC for the various areas were plotted against the time in years during which they had been subject to DDT spraying.

However, both the regression coefficient and the coefficient of correlation were insignificant and it is concluded that even in regions sprayed for 8 years no significant lowering of susceptibility has occurred.

R. J. Wood

DAVIDSON, G. **Insecticide Resistance in *Anopheles sundaicus*.** *Nature.* 1957, Dec. 14, v. 180, 1333–5.

DDT-resistance in adults of *A. sundaicus* was reported in 1954 by CRANDELL [this *Bulletin*, 1955, v. 52, 329] and confirmed by the author

when he visited Java in 1955. For further study, attempts were made to set up laboratory colonies in London. No difficulty in doing this was experienced with the resistant strain, but all efforts to colonize a susceptible strain from Java failed. Eventually a susceptible strain from Malaya was colonized (in London) with some difficulty.

Measurements of the level of resistance by the Busvine test [*ibid.*, 1953, v. 50, 1176] gave figures of the same order as tests in Java (20 to 40 times normal). The resistance extended to two compounds analogous to DDT but not to BHC, dieldrin or aldrin.

Crossing tests gave F_1 progeny scarcely more resistant than the normal (S) parent. A dose which killed all the S and the F_1 hybrids was applied to the inbred F_2 and gave about 75% kill. The F_1 backcrossed to the S colony gave progeny which were nearly all killed by the discriminating dose; while the opposite backcross to the resistant colony gave offspring showing about 50% mortality. These results indicate a single gene for resistance, which is practically recessive.

Since the heterozygotes carrying a recessive gene will be easily killed, it is evident that this type of resistance will take longer to develop in the field than one based on a dominant character. *J. R. Busvine*

Martinez Palacios, A. Pruebas de susceptibilidad al DDT de los anofelinos transmisores del paludismo de la Republica Mexicana. 1. Organización y resultados preliminares. [**Tests of Susceptibility to DDT of Anophelines Transmitting Malaria in Mexico. I. Organization and Preliminary Results**] *CNEP Bol.* Mexico. 1957, Apr.–June, v. 1, No. 2, 12–27, 7 figs. English summary.

The author has conducted tests on the susceptibility levels of Mexican anophelines by the Fay test [this *Bulletin*, 1954, v. 51, 122]. Batches of eggs collected in the field were sent to a central laboratory, where they were hatched and reared to adults. The tests indicated that *A. pseudopunctipennis* was most susceptible to DDT, followed by *A. albimanus* and *A. aztecus*. All three were considerably more susceptible than *A. quadrimaculatus* of the U.S.A. *J. R. Busvine*

Godfrey, D. G. **Antiparasitic Action of Dietary Cod Liver Oil upon *Plasmodium berghei* and its Reversal by Vitamin "E".** *Exper. Parasit.* New York. 1957, Nov., v. 6, No. 6, 555–65, 5 figs.

Previous work (*Exper. Parasit.*, 1957, v. 6, 465) had shown that a diet rich in cod-liver oil suppressed the growth of *Babesia rodhaini* in mice. In the present work it was shown that when mice were fed on a synthetic diet containing 5% cod-liver oil, the multiplication in them of *Plasmodium berghei* was completely suppressed. If, however, adequate amounts of water-soluble vitamins and vitamin E were added to the diet,

P. berghei multiplied as well as in the control animals. It is now well known [this *Bulletin*, 1954, v. 51, 538] that malaria parasites, especially *P. berghei*, require *p*-aminobenzoic acid for multiplication (this is included in the water-soluble vitamins above); but *p*-aminobenzoic acid did not reverse the suppressive action of the cod-liver oil which could be done only by vitamin E, or by other anti-oxidants such as ascorbic acid or tetraethyl thiuram disulphide. The growth of *P. berghei* is not affected by high concentrations of olive oil or of cream in the diet. It is believed that the unsaturated fatty acids of cod-liver oil are oxidized by the host to peroxides. These create a pro-oxidant state in the body of the host which is unfavourable for *P. berghei*. Vitamin E prevents the formation of peroxides by its anti-oxidant properties. *F. Hawking*

BLACKWATER FEVER

PINHÃO, R. C. Dois casos de febre biliosa hemoglobinúrica tratados com cortisona. [**Two Cases of Blackwater Fever treated with Cortisone**] *Gaz. Med. Portuguesa.* 1957, Sept.–Oct., v. 10, No. 5, 629–32.

The English summary appended to the paper is as follows:—

"The author shows two cases of hemoglobinuric billious fever treated by means of cortisone. One of them, in anuric phase, has re-established diuresis with the exclusive use of that drug. Following the communication from ADAMS and PORTE the author is of the opinion that cortisone really achieves promising results in the treatment of this infection, mainly due to its action on diuresis."

[See this *Bulletin*, 1956, v. 53, 412.]

TRYPANOSOMIASIS

*In this section abstracts are arranged as far as possible in the following order:—*African—*human, animal;* American—*Chagas's disease and other trypanosome infections. In each form the following order is followed:—epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.*

INOKI, S., NAKABAYASHI, T., OSAKI, H. & FUKUKITA, S. **Studies on the Immunological Variation in** *Trypanosoma gambiense*. **III. Process of the Antigenic Variation in Mice.** *Med. J. Osaka Univ.* 1957, Mar., v. 7, No. 4, 731–43, 2 charts. [17 refs.]

Mice infected with *Trypanosoma gambiense* were injected with a trypanocidal serum of human origin. Out of a total of 438 mice, 100%

relapsed in 20 days, the majority of relapses occurring between the fourth and tenth days. A further series of 681 mice treated in the same way were killed at daily intervals up to the 9th day after treatment and it was found that the "rate of variation" (*i.e.*, the proportion of strains recovered on relapse with changed antigenic properties, to strains recovered with the same properties as the original strain) rose from 0% on day 1 to 100% on day 5, remaining at about that level until day 9. The rate of variation between different organs showed no significant difference.

[These experiments are presented in a manner which is difficult to understand, as are the conclusions which seem unrelated and based upon earlier work.] *W. E. Ormerod*

FULTON, J. D. & SPOONER, D. F. **Comparison of the Respiratory Activity of an Old and of a Freshly Isolated Strain of** *Trypanosoma rhodesiense*. *Ann. Trop. Med. & Parasit.* 1957, Dec., v. 51, No. 4, 417–21, 1 graph.

JENKINS and GRAINGE [this *Bulletin*, 1957, v. 54, 136] reported that the respiratory rate of an old syringe-passaged strain of *T. rhodesiense* is higher than that of recently isolated strains. The present authors repeated their observations, with greatly improved technique, and confirm that this is the case. During their work they found that under the conditions of the Warburg respirometer, newly isolated trypanosomes are lysed much more rapidly than are those of old laboratory strains. The lysis was largely prevented by increasing the amount of horse serum present in the medium surrounding the trypanosomes from 10% up to 80%. The substances contained in the serum which are thus necessary for the survival of such trypanosomes *in vitro* cannot yet be identified but they are stable to boiling and they pass into the ultra-filtrate. Therefore they are certainly not protein in nature. *F. Hawking*

FOSTER, R. **Observations on Laboratory Colonies of the Tsetse Flies** *Glossina morsitans* **West. and** *Glossina austeni* **Newstead.** *Parasitology*. 1957, Dec., v. 47, Nos. 3/4, 361–74.

The colonies were maintained in a laboratory at Arusha, Tanganyika, on the basis of flies singly in tubes. Earlier trials with small boxes of wood and wire-mesh were unsuccessful; these, applied repeatedly to host animals, acquired their scent which was sufficient to cause hungry flies to expend their energies probing and flying about in the absence of the animal. Full details are given of the method adopted and the conditions, admittedly imperfect, in which the work had to be attempted. Sheep were the usual hosts; they gave better pupal production than rabbits and guineapigs.

The colony originated from wild-caught pupae of *G. morsitans* and three generations of adults were maintained. The colony declined fairly steadily in vigour and numbers; 419 flies (rather more than half of them females) out of 539 lived beyond 10 days in the first generation and only 39 (about 1:1 sex ratio) of 68 flies of the third generation lasted more than 10 days. Mean life in days dropped in successive generations from 74·1 (females) and 52·5 (males) to 47·0 and 38·2 respectively. The longest female life in the first generation was 242 days and in the third generation 103 days. Although insemination was 91 to 100% successful (spermathecal examinations) for the first two generations, the percentage of mated flies producing pupae dropped steadily from 63·5 to 38·3, and finally to 14·3% in the successive generations. A general loss of virility is suggested as the cause of the decline, at least in the first two generations, in view of the high insemination rates.

The first larva took about 25 days to develop and subsequent pupae were deposited at 13-day intervals, or about multiples of 13 days. Mean numbers of pupae per female declined with successive generations (from 4·65 to 2·0); the most was 10 pupae from each of 3 females, all of the first generation. It was found optimal for pupal production to feed flies to engorgement every fourth day. Delaying effects on the larval period of a long interval without food (up to about 10 days) could not be made good by re-instituting more frequent feedings. Pupal hatching was generally good (63 to 75%) but pupal weights declined from 23·7 mgm. (original "wild" pupae) to about 19·0 mgm. for the second and third generations.

Less extensive studies were possible for *G. austeni*, which was kept for much of the time with *G. morsitans* in conditions below optimal. Even so, this species survived better than *morsitans* with mean female lives of 96·9, 46·7, and 71·8 days in three successive generations. Some females produced 13 pupae; the mean yield per female was 7·2 and 5·3 in the first and second generations. The mean interlarval period was 12·3 days compared with 17·0 for *morsitans*. On the whole, *G. austeni* fed more readily and better than the *morsitans* colony. Despite otherwise sub-optimal conditions *austeni* colonized more promisingly than *morsitans*, confirming earlier results and the suggestion that it is potentially a more suitable species for laboratory culture [this *Bulletin*, 1954, v. 51, 778].

In discussion, these conclusions are drawn: regular larval production requires full feeding at regular, short intervals; temperature is critical in facilitating feeding (80–81°F. in this work for *morsitans*); the causes of abortion are still not fully understood. *D. S. Bertram*

See also p. 604, UGANDA PROTECTORATE. **Annual Report of the Tsetse Control Department for the Year ended 31st December, 1956.**

See also p. 602, COLONIAL OFFICE, **Colonial Research 1956–57. Tsetse Fly and Trypanosomiasis Committee. Report for 1956–1957.**

ANGELOFF, S., GALABOFF, S. & NIKOLOFF, P. Elektrophoretische Untersuchungen des infektiösen Prozesses bei Kaninchen mit experimenteller Trypanosomiasis. [**Electrophoretic Examinations of the Infective Process in Rabbits with Experimental Trypanosomiasis**] *Ztschr. f. Immunitätsf. u. Exper. Therap.* 1957, Dec., v. 114, Nos. 5/6, 464–71, 8 figs.

The English summary appended to the paper is as follows:—

"The dynamics of the infective process were obtained through electrophoretic examinations of the blood sera of rabbits with experimental trypanosomiasis [*T. equiperdum*]. It was found that along with the development of the infective process, parallel with the clinical symptoms, electrophoretic and characteristic modifications in the quantity and quality of the sera-albumins are to be observed.

"The albumins gradually diminish until the infective process has come to an end while the globulins, on the contrary, increase. About the 90th day when generally the exitus letalis occurs a reduction of the globulins may be observed. Furthermore, the electrophoretic examinations of the blood serum show new α- and β-fractions, i.e. α_1, α_2, β_1 and β_2, in the course of the infective process.

"During the time of the infective process the increase in γ-globulins is important and may be explained in connection with the immunization process."

BASH-LEWINSON, Dina & GROSSOWICZ, N. **Transaminases of** *Trypanosoma cruzi*. *Bull. Res. Counc. of Israel.* 1957, Aug., v. 6E, No. 2, 91–2. [12 refs.]

"The formation of glutamic acid (from ketoglutarate) was demonstrated with the following amino acids: alanine, aspartic acid, leucine, methionine and norleucine; arginine, isoleucine, histidine, lysine and proline were only slightly active.

"The formation of alanine (from pyruvate) was demonstrated with glutamic acid, histidine, leucine and methionine; arginine, aspartic acid, isoleucine and lysine showed low activity."

KOBERLE, F. **Megacolon.** *J. Trop. Med. & Hyg.* 1958, Jan., v. 61, No. 1, 21–4, 2 figs. [32 refs.]

Following upon the classical description of megacolon in the newborn by Hirschsprung the term "megacolon" was introduced to describe the enormous enlargement of the colon.

The terms "symptomatic" or "secondary" megacolon are repudiated by the author.

Extreme dilatation of the intestine occurs after tumours, constricting

cicatrization, compression and strangulation, but they are not true megacolons. All megaformations are due to the same principle, and megacolon represents dilatation and hypertrophy of a muscular hollow organ where no obstruction is present, and is really due to destruction of the intramural plexus. Complete denervation can never produce dilatation and hypertrophy in hollow muscular organs.

In Brazil the frequent occurrence of megaformations appears to be associated with Chagas's disease.

The author, as the result of careful study, has formed the following conclusions:—

Chagas's disease is characterized by periodic parasitic invasions of the smooth muscles; after 5 days of development the intracellular parasites destroy the muscle host cells and invade the interstitial tissue. The mobile forms of the parasite immediately penetrate into the circulating blood, while the leishmanial forms, unable to develop into extracellular metacyclic forms, die on the spot. Then a neurotoxin liberated by the destroyed parasites reaches the intramural plexus and destroys the ganglion cells.

Although 95% of megacolon cases in Brazil give a positive complement-fixation test for *Trypanosoma cruzi*, yet very few Brazilian workers admit that megaformation is an essential feature of the syndrome of Chagas's disease. The author has frequently emphasized the frequency of megacolon and megaoesophagus as an indication of the incidence of Chagas's disease.

It is also stated [no reference quoted] that "it does not seem to be fortuitous co-incidence that in the Southern States of the U.S.A. the majority of mega cases occur where 95% of all triatomata were found infected by *Trypanosoma cruzi*". *Philip Manson-Bahr*

Zeledón, R. & Vieto, P. L. Susceptibilidad de varias especies de triatóminos a una cepa costarricense de *Schizotrypanum cruzi* Chagas, 1909. [**Susceptibility of Different Species of Triatomids to a Costa Rican Strain of** *Trypanosoma cruzi*] *Rev. Biologia Trop.* San José, Costa Rica. 1957, Dec., v. 5, No. 2, 195–9. [12 refs.]

The English summary appended to the paper is as follows:—

"A study is made of the susceptibility of five species of triatominae to infection by a Costa Rican strain of *Schizotrypanum cruzi* isolated from a specimen of *Triatoma dimidiata* and kept in guinea pigs. The Costa Rican vector species, *T. dimidiata* gave the lowest infection figures, 76·4 per cent; the other four species, all of them of exotic origin, gave the following results: *T. infestans* (Chile), 86·4 per cent; *T. phyllosoma* (Mexico), 83·6 per cent; *Rhodnius prolixus* (El Salvador), 100 per cent; and *R. pallescens* (Panama), 94·3 per cent. A discussion is made of the possibility that *R. prolixus*, at present known only in Costa Rica in the Province of Guanacaste near the Nicaraguan border, might spread further

into the country, increasing the seriousness of trypanosomiasis as a health problem. Lastly, it is recommended that *R. prolixus* be used in Costa Rica for xenodiagnosis, because of its high susceptibility to infection by *S. cruzi.*"

ERRATUM

The name of the author of the paper entitled "Etude de l'infection expérimentale à *Trypanosoma gambiense* du *Cricetomys gambianus*", this *Bulletin*, 1957, v. 54, 1297, should read LARIVIERE, and not LARVIERE.

FEVERS OF THE TYPHUS GROUP

In this section abstracts are arranged as far as possible in the following order:—general; louse-borne typhus, flea-borne typhus, mite-borne typhus; rickettsialpox; tick-borne typhus; Q fever, other rickettsial diseases.

NIEDZIELSKA, Helena. Analiza kliniczna sporadycznych zachorowań na dur wysypkowy. [**Clinical Analysis of Sporadic Cases of Typhus**] *Przegląd Epidemiol.* Warsaw. 1957, v. 11, No. 4, 415–20. [21 refs.]

The English summary appended to the paper is as follows:—

"During the years 1953–1956 58 cases of typhus were under observation in the Clinic for Infectious Diseases of the Medical Academy in Łódź and in the Hospital named after Biegański in Łódź. In 4 cases the source of infection was stated. In the group of sporadic 54 cases 23 patients were afflicted for the second time. In the remaining cases it was not possible to trace the source of infection. The interval between the 1st and 2nd infection amounts on the average to 30–40 years. The age of the patients is between 40–80 years. The patients were hospitalized from the 5th to 14th day of the disease. The temperature lasted from 10 to 12 days. In 15 cases there was no rash. Almost all the patients complained of strong headaches. There were no marked deviations from the normal state in the circulatory and respiratory systems. In all the patients there were: dryness of tongue and the mucous membranes of the oral cavity. In one case there was bilateral parotitis and in one parenchymatous jaundice. Leukopenia up to 5 thousand appeared in 13 cases, in 22 cases the number of leukocytes amounted from 6 to 8 thousand. Leukocytosis from 9–20 thousand was found in 19 cases. Blood sedimentation rate is slightly accelerated. The level of urea in blood—within normal limits. Weil-Felix reaction was positive in 30 patients out of 54. The reaction of the complement fixation with

rickettsial antigen was positive in the cases in question. The patients were treated by means of chloromycetin. There were no deaths in the group of sporadic cases of the disease under discussion."

PÉREZ GALLARDO, F. Sobre el uso de la cepa E de *R. prowazeki* como vacuna contra el tifus exantematico. [**On the Use of Strain E of *Rickettsia prowazeki* as a Vaccine against Typhus exanthematicus**] *Ztschr. f. Tropenmed. u. Parasit.* Stuttgart. 1957, v. 8, No. 4, 464–76. [32 refs.] German summary.

This paper consists of a description of the remarkable avirulent strain E of *Rickettsia prowazeki* which was discovered in Spain in 1943 by CLAVERO and the author [this *Bulletin*, 1944, v. 41, 24]. These workers were making routine yolk-sac passages of a fully virulent strain of *R. prowazeki* and found to their astonishment that when tested at the 11th passage it had lost its virulence while fully retaining its immunizing properties.

No reason could be found for this surprising loss of virulence which has been maintained for 405 passages carried out over a period of 7 years.

The present paper contains little that has not already been referred to in previous abstracts in this *Bulletin*. Recent papers by FOX *et al.* cover much the same ground and have the advantage of dealing more critically with the possible drawbacks of living rickettsial vaccines. [See *ibid.*, 1954, v. 51. 562; 1955, v. 52, 963 and 1179; 1956, v. 53, 1328 and below.] *John W. D. Megaw*

FOX, J. P., JORDAN, Martha E. & GELFAND, H. M. **Immunization of Man against Epidemic Typhus by Infection with Avirulent *Rickettsia prowazeki* Strain E. IV. Persistence of Immunity and a Note as to Differing Complement-Fixation Antigen Requirements in Post-Infection and Post-Vaccination Sera.** *J. Immunology.* 1957, Oct., v. 79, No. 4, 348–54. [13 refs.]

This report contains further observations on the persistence of immunity conferred by vaccination with avirulent *Rickettsia prowazeki* (strain E) [this *Bulletin*, 1956, v. 53, 1328]. When 8 persons who had been vaccinated 48–66 months previously with strain E were challenged intradermally with virulent *R. prowazeki*, the only persons who experienced "typical typhus onsets" were 2 who had failed to develop any detectable antibody after vaccination. A characteristic febrile response occurred in 7 out of 8 presumed non-immune controls who received the standard challenge inocula, 1 control having pyrexia on the 8th day only (this man's serum gave a complement-fixation (CF) reaction suggestive of previous infection with murine typhus). From these and previous results, it is concluded that resistance produced by inoculation with *R.*

prowazeki strain E persists for at least 66 months, and probably for many years, in persons who develop neutralizing antibodies after vaccination.

CF tests with different doses of antigen indicated that antibody developing during the first weeks after experience of rickettsial antigen in an infection with virulent or avirulent (strain E) *R. prowazeki* differed from that present later in that an increased amount of antigen (8 units) was needed for its demonstration; this newly-formed antibody, which was not detected after inoculation with non-infective Cox-type vaccine, was liable to inactivation at 60°C. *R. S. F. Hennessey*

SCHAECHTER, M., TOUSIMIS, A. J., COHN, Z. A., ROSEN, H., CAMPBELL, J. & HAHN, F. E. **Morphological, Chemical, and Serological Studies of the Cell Walls of** *Rickettsia mooseri*. *J. Bacteriology*. 1957, Dec., v. 74, No. 6, 822–9, 7 figs. [28 refs.]

"Cell walls of relative morphological purity were prepared from *Rickettsia mooseri* by controlled treatment with sodium desoxycholate. Chemical analyses revealed that these structures contain amino acids, polysaccharide, and small amounts of ribonucleic acid. Twelve amino acids were identified in acid hydrolyzates. No appreciable amounts of methionine, arginine, and histidine were found. The polysaccharide moiety contains glucose, hexosamine, glucuronic acid, and galactose, as determined by paper chromatography.

"Complement fixation tests demonstrated the presence of a group reactive antigen. An erythrocyte sensitizing substance was found in much greater amounts in the cell wall than in the rest of the organism."

WHITMIRE, Carrie E.; DOWNS, Cora M. **Effects of Cortisone on Experimental Murine Typhus. I. Susceptibility of the Syrian Hamster to Murine Typhus and the Effect of Cortisone** [WHITMIRE]. *J. Bacteriology*. 1957, Oct., v. 74, No. 4, 417–24, 2 figs. [16 refs.] **II. Effect of Cortisone on the Comparative Susceptibility of Laboratory Animals to Infection with Murine Typhus** [WHITMIRE & DOWNS]. *Ibid.*, 425–31, 2 figs. [16 refs.] **III. Effect of Cortisone on the Immune Response in Mice, Rabbits, and Guinea Pigs** [DOWNS & WHITMIRE]. *Ibid.*, 432–8. [26 refs.]

In an investigation of the effects produced by *Rickettsia typhi* [*mooseri*] in laboratory animals it was observed that susceptibility to infection was greatest in the mouse. In descending order followed the cotton rat, guineapig and hamster. After administration of varying amounts of cortisone the hamsters became most susceptible to fatal infection, followed by the mouse and cotton rat. After similar cortisone administration fatal infections did not supervene in guineapigs.

Adult male guineapigs and hamsters responded to intraperitoneal injection of viable *Rickettsia mooseri* by the production of scrotal induration. This was suppressed in the guineapig if the infecting dose was small and the animal was treated with cortisone. Complete suppression of the scrotal induration was possible in hamsters, but administration of cortisone invariably provoked a fatal generalized infection. It was also noted that an initial quiescent infection in a hamster could be activated to produce a fatal illness in 24 hours by cortisone. The effect of cortisone on the immune response of mice, cotton rats, hamsters, guineapigs and rabbits was observed. No alteration occurred in the mouse. Insufficient experimental evidence was produced in the cases of the cotton rat and hamster to draw conclusions, while in the guineapig and rabbit development of complement-fixation (CF) antibody was delayed. In most instances rabbits treated with cortisone eventually produced a higher level of CF antibody than animals which were not so treated. No difference was observed in CF antibody titres when rabbits were immunized with whole rickettsiae or with organisms lysed by sonic vibrations.

In all animals dying of infection by *Rickettsia mooseri* the presence of a heat-stable haemagglutination-inhibiting antigen was demonstrated.

R. G. Sommerville

Jackson, Elizabeth B., Danauskas, J. X., Smadel, J. E., Fuller, H. S., Coale, Mary C. & Bozeman, F. Marilyn. **Occurrence of** *Rickettsia tsutsugamushi* **in Korean Rodents and Chiggers.** *Amer. J. Hyg.* 1957, Nov., v. 66, No. 3, 309–20, 1 fig. [31 refs.]

During attempts to isolate the agent of epidemic haemorrhagic fever, *Rickettsia tsutsugamushi* was fortuitously recovered by inoculating hamsters with pooled liver and spleen tissue of 3 field mice (*Apodemus agrarius*) trapped in Korea in 1952. When the identity of the organism had been established by means of cross-immunity and complement-fixation tests, a survey of the extent of the infection among rodents collected in various parts of Korea gave recoveries of *R. tsutsugamushi* in 5 out of 7 areas, isolations being made by mouse inoculation of material from 11 out of 77 *A. agrarius* and 1 out of 9 *Microtus fortis*; the organism was also isolated from 5 pools of tissues from *A. agrarius*, 1 pool from *M. fortis* and 1 pool from *Micromys minutus*. Larval chigger-mites (*Trombicula pallida*) collected from wild rodents in Korea and cultured in Washington proved to be naturally infected, both these mites and their larval progeny (which must have been infected *via* the egg) transmitting *R. tsutsugamushi* to suckling mice on which they had been fed.

As 17% of the Korean rodents examined for *R. tsutsugamushi* were found to be infected, while only 8 cases of scrub typhus were detected among United Nations personnel during the period 1951–54, it seems that the vector for rodents (probably *T. pallida*) is only an occasional vector for man.

R. S. F. Hennessey

JACKSON, Elizabeth B., DANAUSKAS, J. X., COALE, Mary C. & SMADEL, J. E. **Recovery of** *Rickettsia akari* **from the Korean Vole** *Microtus fortis pelliceus*. *Amer. J. Hyg.* 1957, Nov., v. 66, No. 3, 301–8. [21 refs.]

Intraperitoneal inoculation of mice with a suspension of liver, spleen and kidney tissue from a reed vole (*Microtus fortis pelliceus*, an indigenous field rodent) trapped in Korea in 1952 caused no apparent illness, but a blind passage of material from these mice led to the isolation of a transmissible agent which proved to be indistinguishable from *Rickettsia akari* in cross-immunity tests and complement-fixation tests with type-specific antisera. This is the first recorded isolation of *R. akari* in Korea, where rickettsialpox has not yet been recognized. The finding is of special interest in that the organism has previously been associated only with wild commensal mice and rats; its presence in a field rodent "suggests that the ecology of rickettsialpox includes a natural cycle independent of man or his rodent companions". *R. S. F. Hennessey*

IRONS, J. V., EADS, R. B. & PEAVY, J. E. **Q Fever in Texas.** *Texas Reports on Biol. & Med.* 1957, v. 15, No. 4, 896–903, 1 fig. [15 refs.]

This paper summarizes observations on 64 cases of Q fever recognized in Texas between September 1948 and December 1955. The great majority of those affected were associated with livestock, particularly cattle; 48 were males. The onset was usually acute, with X-ray signs of pneumonitis in those who became severely ill. Pyrexia (often 103–104°F.) generally persisted over 4–7 days or more. Few could recall a tick-bite near the onset of illness; inhalation of dust around dairy barns, cattle trucks and livestock pens was a possible mode of infection in the majority of cases. Complement-fixing antibodies for *Rickettsia burneti* reached a titre of 1 in 40 or higher by the end of the 3rd week, a 4-fold rise in titre usually being demonstrable if specimens were taken before the 10th day and after the 17th day.

R. burneti was found in 8 dairy herds, in each of which from 1 to 3 animals were "shedders"; all were in South Texas. Attempts to isolate *R. burneti* from ticks and other arthropods collected in the field were unsuccessful.

[See also this *Bulletin*, 1948, v. 45, 783; 1949, v. 46, 726 *bis*; 1952, v. 49, 499; 1957, v. 54, 21.] *R. S. F. Hennessey*

YELLOW FEVER

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.

GAST GALVIS, A. Incidencia de la fiebre amarilla en diferentes zonas de Colombia. [**Monthly and Annual Incidence of Yellow Fever in Colombia**] *Bol. Oficina Sanitaria Panamericana.* 1958, Jan., v. 44, No. 1, 10–19, 1 map.

The English summary appended to the paper is as follows:—

"1. A description is given of four geographically different areas in which yellow fever is endemic.

"2. For those areas, a relation is shown between the number of cases occurring monthly and the precipitation recorded in representative localities in each region. The monthly incidence indicated that the largest number of cases occur in the months of December and January, when the dry season begins; another rise of less intensity occurs in July.

"3. It is shown that more than half of the cases (60·8 per cent) occur in the Magdalena River area. Of the 361 cases studied in that area, only 34 came from the Valley (19 from the left bank, 15 from the right), the others having become infected in the mountains near the Valley and along the Magdalena tributaries.

"4. The annual incidence shows periodic outbreaks in the Amazonia and Catatumbo regions. In the Pie de monte de los Llanos area and the Magdalena Valley, lulls are of shorter duration and endemicity is more constant.

"5. During the early years a rise in the annual number of cases was observed at intervals of from four to five years; since 1947, no appreciable increase has been noted, the curve tending to remain constant, with annual variations of from 10 to 20 cases."

KERR, J. A. Los métodos utilizados en el estudio de la fiebre amarilla selvática. [**Methods used in Study of Jungle Yellow Fever**] *Bol. Oficina Sanitaria Panamericana.* 1958, Jan., v. 44, No. 1, 1–9, 4 figs. English summary.

See also p. 585, MUSPRATT, **The *Stegomyia* Mosquitoes of South Africa and some Neighbouring Territories. Including Chapters on the Mosquito-Borne Virus Diseases of the Ethiopian Zoo-Geographical Region of Africa.**

BARBARESCHI, G. Glomerulosi tossica in febbre gialla. [**Toxic Glomerulosis in Yellow Fever**] *Rev. Biologia Trop.* San José, Costa Rica. 1957, Dec., v. 5, No. 2, 201–9, 4 figs. on pl. [14 refs.]

The English summary appended to the paper is as follows:—

"The present study is based on autopsy study of 70 fatal cases of

yellow fever during the epidemic of 1952–53 in Costa Rica. Material was fixed in formaldehyde, Zenker's fluid, alcohol, and mercuric chloride solutions. The following stains were used in series: hematoxylin-eosin, Mallory, Van Gieson, Weigert (elastic fibers, fibrin), Gallego, Feulgen, congo red, methyl violet, anilin blue, May-Gruenwald-Giemsa, Sudan III, and silver impregnation for reticulum.

" Observations revealed glomerular alterations produced in the course of yellow fever with hepato-renal syndrome, consisting of glomerulosic, Schiff-positive transformation of the basal membrane or lamina densa, causing an altered permeability to proteins with infiltration (proteinuria) and establishment of an acute nephrotic syndrome.

" Such glomerulosic lesions are difficult to observe with hematoxylin-eosin alone, for which reason it has been held hitherto that the glomerulus is not affected in the hepato-renal syndrome."

[The term " glomerulosis " has been adopted to indicate a lesion of the metamorphic, regressive, disintegrative type, or of the thesaurotic (over-storage) type, at the level of the differentiated mesenchymal structures of the glomerulus, or more precisely at the level of its basement membrane.]

RABIES

Horn, W. & Pitzschke, H. Infektionsquellen der Tollwut. [**Sources of Rabies Infection**] *Ztschr. f.d.g. Hyg. u. ihre Grenzgebiete.* Berlin. 1957, Sept.–Oct., v. 5, No. 3, 358–65, 2 figs.

After the First World War a considerable spread of rabies infection occurred in Germany. By the end of the 1920's the infection had been almost entirely eradicated except in eastern frontier areas where, however, outbreaks occurred which were localized by the control organization. This course of events recurred after the Second World War and is here described as it was experienced in Thuringia [see also this *Bulletin*, 1957, v. 54, 27]. Maps record the distribution of the 1,228 cases of rabies infection found in 3,909 domestic and wild animals, examined in the period 1952–56 by methods which are described, in the veterinary health institute in Jena. Among 219 positive domestic animals were 90 dogs and 116 cats; among 1,009 positive wild animals were 862 foxes, 46 badgers and 92 deer. In the period 1953–55 a total of 809 persons who had been bitten by or in contact with rabies-positive animals were given protective inoculations. A table sets out the details.

There follows a description of the methods of official control, destruction of infected and suspected animals and public education which were successful in limiting the rabies infection. The value of preventive

inoculation is discussed with mention of 2 fatal cases of rabies in Thuringia in persons who had not been vaccinated. Stress is laid on the fact that success in combating rabies outbreaks can only be secured by the close cooperation between the medical and veterinary professions, official control officers and those concerned directly with wild animals. Instruction of the people, particularly of schoolchildren, is also essential.

M. E. Delafield

NIKOLITSCH, M. & JELESITSCH, Z. Phänomen der Eklipse bei dem Tollwutvirus und der Einfluss des Immunserums auf extraneurale Viren. [**The Eclipse Phenomenon with Rabies Virus and the Effect of Immune Serum on Extraneural Virus**] *Arch. f. Hyg. u. Bakt.* 1957, Nov., v. 141, No. 7, 532–7.

The persistence of street rabies virus at the site of inoculation was investigated by infecting mice in the thigh muscles and inoculating groups of mice intracerebrally with suspensions of muscle from animals killed at intervals up to 120 hours. Virus was present up to 48 hours but could no longer be detected after 72 hours. In similar experiments in which rabies immune serum was injected intraperitoneally at the time of infection the virus could be detected at the site of injection up to 6 hours; it was not found after 12 and 24 hours, and a minimal amount was detectable after 48 hours. It was thus not possible to neutralize all the virus at the site of injection by the administration of immune serum.

D. J. Bauer

PLACIDI, L. & CHEVRIER, L. Réaction du hérisson (*Oetechinus algirus algirus*) à l'inoculation du virus rabique et, notamment, de la souche Flury. [**Reaction of Hedgehogs** (*Oetechinus algirus algirus*) **to Inoculation of Rabies Virus, particularly the Flury Strain**] *Ann. Inst. Pasteur.* 1957, Oct., v. 93, No. 4, 489–501. [14 refs.]

The Flury strain of rabies virus and a fixed and a street strain have been carried through a number of intracerebral passages in the hedgehog *Oetechinus algirus algirus*. All strains produced a fatal illness of paralytic type without any stage of excitation. The survival time with fixed virus was 17–21 days, and with street virus 23–29 days. Of 28 hedgehogs inoculated with the Flury strain 3 showed no signs of illness, and death ensued in the others after 21–86 days. The survival time in hedgehogs was therefore somewhat longer than in guineapigs and rabbits infected with the same strains; in rabbits and guineapigs infected with virus adapted to hedgehogs it was also longer than usual but reverted to the normal length after 2 or 3 further passages. Negri bodies were found only in animals infected with the street strain *D. J. Bauer*

Malaga Alba, A. & Villa R., B. Algunas notas acerca de la distribución de los murciélagos de América del Norte relacionados con el problema de la rabia. [**Notes on the Distribution of North American Bats in Relation to the Rabies Problem**] *An. Inst. Biol.* Mexico. 1956, v. 27, No. 2, 529–69, 8 figs. & 10 maps. [21 refs.]

The authors, from the Oficina Sanitaria Panamericana, discuss at length the association between rabies and haematophagous bats on the one hand, and insectivorous bats on the other. Of 12 species of insectivorous bats in the United States which have been shown to be infected with rabies, 8 are also found in Mexico: these are listed and, together with several other species found in Mexico, their distributions are set out fully in tables and in 10 maps. There are also 8 photographs of different species.

The authors discuss the ecological and other differences between the insectivorous and the haematophagous bats and their possible epidemiological significance in relation to rabies in man and animals. The information given will be very useful for those concerned with these aspects of rabies in North America.

[See also this *Bulletin*, 1957, v. 54, 29, 676, 949, 1177, 1406.]

H. J. O'D. Burke-Gaffney

Martin, R. & Atanasiu, P. A propos d'un cas de rage. Faut-il associer le sérum hyperimmun antirabique au vaccin? [**Observations on a Case of Hydrophobia. Should Hyperimmune Serum be associated with Vaccine in Anti-Rabies Treatment?**] *Bull. Acad. Nat. Méd.* 1957, v. 141, Nos. 32/33, 694–9. [12 refs.]

For the first time since 1920 a case of hydrophobia was treated at the hospital of the Pasteur Institute, Paris, in January 1957. The case occurred in a 53-year-old woman who, while on business in Morocco, had on 10th November 1956 been bitten by a dog on the back of the right hand. The dog, which was immediately impounded, died suddenly on the 9th day of its observation period, without having shown any signs of rabies. Specific treatment of the bitten woman was begun on 19th November, the day of the dog's death, and continued uninterruptedly for 25 days until 13th December. On each day of treatment 5 ml. of phenolized anti-rabies vaccine was administered at the Pasteur Institute, Casablanca. Throughout the treatment period the woman was more than ordinarily occupied with the business affairs which had brought her from Paris. On 31st December she returned by air to Paris, where on the evening of her arrival she developed a painful paresis of the right upper extremity, ascribed to her having been exposed to a draught during the flight. On 5th January she had headache, shivering attacks and a temperature of 39°C. (102·2°F.); diagnosis of a meningitic syndrome and of query hydrophobia occasioned admission to hospital later in the day. Next day symptomatology was more indicative of influenza, but on 8th January,

with remission of temperature to normal, the patient showed marked anxiety, aerophobia, difficulty in swallowing, slight paralysis of the palate and paresis of the nuchal muscles. Suddenly in the afternoon of 8th January the temperature again rose to 39°C., the eyes became wild looking, speech difficult and swallowing impossible; later, after periods of intense excitement and profuse salivation, signs of encephalitis and bulbar paralysis became more and more marked and the patient died in coma during the night.

In this case, where death occurred 59 days after wounding by a rabid dog—histological examination had revealed the presence of Negri bodies in the animal's brain—full laboratory investigations were carried out on material obtained from the patient after death. Microscopic examination of various parts of the central nervous system showed numerous Negri bodies in sections made from the medulla; virus was isolated by the intracerebral inoculation of rabbits and mice with 1 in 100 suspensions of the medulla; and proof of identity of the virus so isolated was established by the serum-virus neutralization test, in the performance of which use was made of 1 in 100 brain suspensions from one of the infected mice and a hyperimmune horse serum capable in a dilution of 1 in 1,580 of neutralizing 150 LD50 of virus. That the patient had died of rabies was thus confirmed and in this connexion it is of interest to observe that a sample of her serum, taken immediately after death, proved capable in a dilution of 1 in 85 of neutralizing 100 LD50 of standard challenge virus (CVS).

In discussing the failure of vaccine treatment in the present case, the authors suggest as contributory causes: delay in commencing treatment, fatigue induced by overwork during and after treatment, exposure to cold in the aircraft, and a mild influenza attack—the influenza virus activating the pre-existing, latent rabies virus.

Whether the use of hyperimmune serum in combination with vaccine treatment might have saved the patient is then considered. It is known that passive antibody appears in the blood stream within one day after inoculation of hyperimmune serum and persists at a good level for at least 10 days; also that active antibody response to vaccine treatment is ordinarily demonstrable by the 10th day after the first injection. Hyperimmune serum should, therefore, confer protection until the vaccine has had time to produce active antibody. To be effective, however, serum must be given within 48 hours of the time of wounding and in the present case specific treatment was begun only 9 days after the bite. Study of all available evidence leads the authors to advocate the combined use of serum and vaccine in the treatment of persons definitely at risk, provided serum can be administered within 48 hours of exposure.

Finally the possible recrudescence of rabies in France is discussed—a possibility made all the more likely by prevalence of the disease among animals in adjacent territories (Germany, Italy and Spain), by the appearance since 1955 of various foci of infection in the Departments of

the Lower and Upper Pyrenees, Gers and Bouches-du-Rhône, and by the introduction of infected dogs accompanying troops returning from North Africa, where rabies is enzootic. *G. Stuart*

WANG, San-Pin. **Neutralizing Antibody Response to Vaccine and/or Antiserum Treatment in Rabies Prophylaxis.** *J. Formosan Med. Ass.* 1957, July v. 56, No. 7, 307–17, 2 figs. [14 refs.]

16 persons were given a full course of immunization with phenolized rabbit or goat brain rabies vaccine, consisting of 14 daily doses, and the formation of neutralizing antibody was studied in sera collected at intervals up to 28 weeks from the beginning of vaccination. Antibody appeared after 2–3 weeks and titres of up to 3·8 log units were observed. After 2 years 4 persons with residual titres of 0·52–1·70 log units were given 3–4 further doses of goat brain vaccine, and 2 weeks later the titres had risen to 2·95–3·56 log units and remained at a high level for 10 months.

In similar experiments in goats neutralizing antibody was present in the serum 14 days after beginning vaccination, and appeared in the cerebrospinal fluid after 14–21 days. In goats given antiserum no antibody appeared in the cerebrospinal fluid, and the serum antibody declined rapidly after 10–14 days. In goats treated both with antiserum and with vaccine, antibody due to active immunization began to appear before the injected antibody had disappeared. *D. J. Bauer*

CONSTANTINESCU, N., ŞTIRBU, A., CHEPTEA, A. & TAINDEL, C. Studiu asupra activităţii protectoare comparative a serului antirabic şi a vaccinurilor fenolate în turbarea experimentală. [**Studies on the Comparative Protective Effects of Rabies Antiserum and Phenolized Vaccines in Experimental Rabies**] *Studii şi Cercetări Inframicrobiol., Microbiol. şi Parazitol.* 1956, July–Dec., v. 7, Nos. 3/4, 423–70, 7 figs. [40 refs.] French summary.

In a comparative study carried out on a total of 208 rats of the efficacy of intensive, moderate and short courses of inoculation with phenolized and heat-inactivated phenolized rabies vaccine the best results were obtained with a short course of phenolized vaccine (8 doses of 0·1 cc. with 2-day intervals), which gave 82% protection against intracerebral challenge with 2,000 LD50 of the Babeş strain of fixed rabies virus. The heat-inactivated vaccine was ineffective. Rabies hyperimmune serum was prepared by immunizing 25 sheep with attenuated and virulent fixed virus, and neutralization titres up to 9×10^5 were obtained. The effect of treatment with antiserum alone or combined with phenolized vaccine was investigated in 1,408 dogs, rabbits, guineapigs, rats and mice infected intramuscularly with street or fixed virus. The protection conferred by

the antiserum was dependent upon the severity of the infection, as judged by the precentage mortality and survival time in control animals. In severe infections the percentage of animals protected ranged from 20 to 28 in different groups, compared with 0–18% in animals treated with antiserum and vaccine and 0–10% with vaccine alone; the figures for moderate infections were 41–78%, 55–75% and 6–26% respectively, and for mild infections 50–100% with antiserum alone and 23–100% with vaccine alone. *D. J. Bauer*

PLAGUE

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, rodent hosts, transmission, pathology, diagnosis, clinical findings, treatment, control.

SRIKANTAN, T. N., KRISHNA MURTI, C. R. & SHRIVASTAVA, D. L. **Studies on the Enzyme Make-Up of** *Pasteurella pestis*. **Part VI. Aldolase Activity of Virulent and Avirulent Strains.** *Indian J. Med. Res.* 1958, Jan., v. 46, No. 1, 1–8, 2 graphs.

"1. Aldolase activity of cell extracts of eight strains each of virulent and avirulent *P. pestis* has been reported. No correlation is observed between enzyme activity and virulence. The effect of enzyme and substrate concentrations, temperature of growth of organism and pH of reaction on the activity of the enzyme has been studied.

"2. Cobalt has an activating action on the enzyme. Phenanthroline and ethylene diaminetetracetic acid inhibit it. Ascorbic acid has no action, whereas cysteine has a profound activating effect. In low concentrations 8-hydroxyquinoline also activates the enzyme.

"3. Of the antibiotics studied, neomycin and chloramphenicol were found to have no action and dihydrostreptomycin partially inhibited enzyme. Both oxytetracycline and tetracycline inactivated the enzyme, whereas in contrast chlortetracycline in identical concentrations activated it."

FUKUI, G. M., OGG, J. E., WESSMAN, G. E. & SURGALLA, M. J. **Studies on the Relation of Cultural Conditions and Virulence of** *Pasteurella pestis*. *J. Bacteriology*. 1957, Dec., v. 74, No. 6, 714–17.

"Growth of several virulent strains of *Pasteurella pestis* in aerated liquid cultures at 37 C consistently resulted in loss of virulence. This loss did not occur in similar cultures incubated at 26 C or on solid media at either 26 or 37 C. The loss of virulence was attributed to selection of avirulent mutants."

Miles, V. I. & Kinney, Alva R. **An Apparatus for Rapid Collection of Fleas from Rodent Nests.** *J. Parasitology.* 1957, Dec., v. 43, No. 6, 656–8, 2 figs.

The apparatus is a modified form of Berlese funnel. Instead of heating by means of a water jacket, a 1,300 watt electric heating unit and fan (750 r.p.m.) are mounted above the funnel. Warm air is driven downwards through the funnel, over the nest material, towards the collecting vessel. Nest material is pulled apart in the top mesh tray in the funnel, and most of the debris is prevented from falling into the collecting vessel by lower trays of finer mesh. All of the fleas present in average nests have been collected after heating with 1,000 watts for 10–15 minutes, but large, damp nests require 1,300 watts for up to 30 minutes. The fleas are collected alive, and do not appear to be affected adversely by the heat (up to 50°C. in 10–30 minutes). This apparatus may also be useful for the collection of other small arthropods. *B. R. Laurence*

Kartman, L. **The Concept of Vector Efficiency in Experimental Studies of Plague.** *Exper. Parasit.* New York. 1957, Nov., v. 6, No. 6, 599–609. [25 refs.]

This paper attempts to sum up what progress has been made and to indicate what remains yet to be done to provide an index of vector potential which would be adequate for comparing the efficiency of different species of flea as vectors of plague. The pioneer work of earlier years was much dependent for comparisons on experimental exposure of animals to masses of fleas, potentially able to transmit. Later, and particularly more recently, emphasis has been on factors which could be studied by suitable laboratory experiment and observation directly on infected fleas. The present paper takes the problem further by combining certain numerical indices based on laboratory and on field studies to give a figure for Plague Vector Potential. Basically, the Plague Vector Potential of a flea species is obtained by multiplication together of certain numerical values which vary from one species of flea to another. There is, first, an Experimental Vector Index (a) which itself is the product of the following proportions in fleas examined after feeding in the laboratory on a septicaemic animal:—fleas infected when fed on the septicaemic host (the infection potential); infected fleas which then become blocked and infective (blocking or [unfortunate confusion] vector potential); infective fleas actually transmitting to experimental animals at daily opportunities (transmission potential); and a fourth factor (blocking-survival potential) which is a ratio of the time a flea takes to get blocked to its survival time once blocked. Laboratory studies provide the data for these elements. From field work, one derives next a Field Infection Index (b) which is the proportion of fleas of a species (or pools of that species) which cause infection when inoculated into a test animal.

Thirdly, there is the Field Prevalence Index (c) which is in effect the flea-index of rodents (or their nests) for the particular flea species in question. The Plague Vector Potential of the flea species is (a) × (b) × (c) × 100.

Data are given which compare this potential for *Hystrichopsylla linsdalei* and *Malaracus telchinum*, fleas concerned in a plague epizootic in the San Francisco Bay region. The three indices—(a), (b) and (c)—are given, and the Plague Vector Potentials are, respectively, 0·02 and 0. A deficiency of this elaborate index of plague vector potential is manifest in this representation of *Malaracus* as apparently a non-vector, as it is known to transmit [probably mechanically] if present in large numbers on its host. This the author notes and indicates that, besides other factors to be considered in individual instances (these are given general indications in different parts of the text), there is need to incorporate in the Plague Vector Potential a measure of a flea species' ability for mass transmission. [This paper is a useful effort to improve the methods of comparing the vector efficiency of different species of fleas and is intended as a basis for further work and development towards a more satisfactory and comprehensive concept.]

[See also this *Bulletin*, 1946, v. 43, 35; 1957, v. 54, 32, 678.]

D. S. Bertram

MURRAY, K. F. **An Ecological Appraisal of Host-Ectoparasite Relationships in a Zone of Epizootic Plague in Central California.** *Amer. J. Trop. Med. & Hyg.* 1957, Nov., v. 6, No. 6, 1068–86, 1 fig.

In the course of a survey by the San Francisco Field Station of the U.S. Public Health Service in the spring of 1953 several pools of wild mice were found infected with plague in the San Bruno Mountains in the San Francisco Bay area. A special feature of the site was the presence of two hog farms infested with Norwegian rats, so that the transfer of ectoparasites from the wild to the domestic rodents came up for consideration. Several pools of wild mice were found positive for plague in July 1953 and again frequently throughout the spring of 1954.

Rat poisoning of the area was carried out in May 1954, and intensive control measures were effected in the hog farms.

It was thought desirable to survey the extent of the epizootic by a team from the Bureau of Vector Control of the State Department of Public Health and to take the opportunity of assessing the host–ectoparasite relationships which might have a bearing on the occurrence of plague among human beings.

Trapping of rodents over a wide area was carried out in 25 sites in each of which 25–50 "Museum Special" snap traps were used. Various different types of vegetation were chosen for the sites and it was found that small mammals were most abundant in scrub areas; they were very scarce in dense woods and grazed grassland.

Full details are given of all the small mammals captured and of their

fleas. Plague was recovered from only 2 pools of fleas; one was a pool of 2 *Opisodasys keeni* collected from a single *Reithrodontomys megalotis*; the other was a pool of 8 *Malareus telchinum* collected from 2 *Microtus californicus*.

Both of the sites in which infected fleas were found lay near the area in which infection had been found in the earlier surveys, so it seemed likely that the epizootic had not extended far beyond the area already known to be infected.

The control operation carried out was the distribution of poison grain by air over an area of 500 acres in the zone known to be infected. By repeated trapping afterwards apparent reduction in the rat population by 25–80% was registered in 4 different areas, but 2 months later the population was restored to the original level.

The density of the flea population on the hosts increased sharply just after poisoning was carried out.

It was concluded that poisoning was ineffective in reducing the transmission potential among wild rodents, but, on the other hand, rats were successfully controlled on the hog farms; it seemed likely that the thorough suppression of domestic rats would remove the risk of transmission of plague from wild rodents to human beings.

Those interested in the problem of plague of wild rodents must read the original paper. *John W. D. Megaw*

WILK, W. Vergleichende pharmakologische und toxikologische Prüfung von Scillirosid-, Alpha-Naphthylthioharnstoff- und Cumarin-Präparaten. (Experimenteller Beitrag zur Rattenvertilgung.) [**Comparative Pharmacological and Toxicological Examination of Scillirosid, Alpha-naphthylthiourea and Coumarin Preparations. Experimental Study on the Extermination of Rats**] *Ztschr. f. Angewandte Zool.* 1957, v. 44, No. 4, 419–46, 4 figs. [Numerous refs.]

CHOLERA

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

ROGERS, L. **Forecasting and Control of Cholera Epidemics in South-East Asia and China.** *Lancet.* 1958, Jan. 18, 151–4, 2 figs. [10 refs.]

This is a very remarkable paper, not only because of its great value and importance but also because it was published on the 90th birthday of

its distinguished author. In a special comment the Editor of *The Lancet* states: " . . . We felt that an agreeable adventitious flavour would be given to Sir Leonard Rogers' latest contribution if we kept it for this week. For he was born on Jan. 18, 1868 ". Sir Leonard's many friends and admirers will have special pleasure in reading the paper because they will find that it contains clear evidence of his undiminished enthusiasm and genius for research in spite of anything the calendar may suggest.

The present article is a sequel of the one abstracted in this *Bulletin*, 1958, v. 55, 401. It describes an epidemiological study of cholera in Burma, Thailand, Indo-China and China, with special reference to the problem of controlling the disease in these countries by large-scale inoculation on the lines that have already proved so successful in the Indian subcontinent.

In all the above countries except China, the average absolute humidity rates remain above 0·400 in January and February, so that, as shown by the author, conditions remain favourable for the persistence of cholera in endemic form throughout the year. The area concerned is conterminous with the endemic areas of Assam and of what used to be called Bengal. The main part of China differs in that the absolute humidity rate in winter (November to March) falls well below the critical height of 0·400 so that conditions are unsuitable for the maintenance of endemic cholera. This applies to the huge area from the Yangtse Valley northwards; in these, epidemics occur from time to time. In South China the absolute humidity rate from December to February remains on the border of 0·400 and cholera becomes greatly reduced during these months. In March the rate rises and epidemics often occur.

Records are not available to show the intensity of epidemics in China but Dr. Wu Lien-Teh (*Reports National Quarantine Service, Ser. III*, 1932) has described those occurring since 1900 and has classified them into three grades according to their severity. In grade III he includes the 6 severest epidemics which spread over the greater part of China; grade II were less severe, involving central China and the Yangtse Valley; there were 12 of these. Of the mildest, grade I, there were 9; these did not extend beyond south China.

A study of these epidemics and a comparison of their relationship in time to the epidemics in India, Burma and South-East Asia led the author to the conclusion that they were essentially due to the spread of the disease from the endemic areas of Eastern Bengal, Burma, Thailand and Indo-China across the southern border of China. It is mentioned, however, that one of the greatest of the grade III epidemics—in 1932—was exceptional in not being associated with previous special cholera prevalence in the countries south of China and it seemed likely that the infection had entered by sea *via* Shanghai.

From the annual medical reports of Burma it was found that about 300,000 labourers have been in the habit of travelling every year from Eastern Bengal to Burma, and that yearly festivals held at the Burmese

pagodas are attended by about 280,000 pilgrims who often caused outbreaks of the disease. Such movements of the population would account for the spread of infection in, and from, the endemic areas.

In earlier studies [this *Bulletin*, 1929, v. 26, 83] the author had already shown that in Burma from 1877 to 1922 there were 15 years in which the cholera incidence was 50% or more above the yearly average, and that in every one of these years the rainfall during the second half of the previous year had been seriously in defect. The same thing had been shown to occur in the adjoining areas of Eastern Bengal and Assam. In all these regions the annual rise in cholera incidence starts in October to December, immediately after the cessation of the monsoon rains. From an early failure of the monsoon and of the rainfall of the last quarter of the year it is possible to predict the early rise of the cholera incidence and also a high total incidence during the next 12 months. The disease tends to spread northwards from these endemic areas and to invade China, but only at a later date, from the end of April onwards, when the absolute humidity in China has risen well above the critical point of 0·400. Ample warning is therefore available to allow large-scale inoculation in the parts of China which are threatened.

The final solution of the problem is regarded as the yearly compulsory inoculation of all pilgrims, immigrants and travellers from without and within the endemic regions of Burma, Thailand and Indo-China. This measure is expected to stamp out cholera in the area within about 10 years.

This contribution cannot fail to be of the utmost importance to the people of China and South-East Asia. It is offered to them by one who has already made many gifts of immeasurable value to the peoples of tropical countries. *John W. D. Megaw*

Burrows, W. **Studies on Immunity to Asiatic Cholera. IX. Electrophoretic Fractions of Cell Wall and Intracellular Substance of** *Vibrio cholerae* **and their Occurrence in Successive Isolates during the Course of the Disease.** *J. Infect. Dis.* 1957, July–Aug., v. 101, No. 1, 73–84, 8 figs. [12 refs.]

Preparations of the cell wall and intracellular substance of 32 strains of *Vibrio cholerae* were made. 9 of the strains examined were isolated from fatal cases. The electrophoretic mobility of the carbohydrate and protein components was studied. O strains isolated on the 1st or 2nd day of the disease in fatal cases could be distinguished from non-fatal O strains by the greater amount of faster moving intracellular polysaccharide and cell wall protein present. R strains differed from O strains in the composition of both intracellular polysaccharide and protein. Changes in the proportions of some of the mobility fractions took place in serial isolates and this was thought to indicate an *in vivo* variation of the organism.

Sheila McDonald

KHRISTOVA, A. S. & GYLYBOV, K. S. **Immunogenesis in Anti-Cholera Vaccination with the Usual and with Shortened Intervals between Inoculations. (Preliminary Communication.)** *J. Microbiol., Epidemiol. & Immunobiol.* London. 1957, v. 28, No. 4, 538–41, 3 figs. [Translated from Russian.]

Rabbits inoculated with 3 doses of a heated monovalent *Vibrio cholerae* vaccine (Inaba) developed agglutinins to a higher titre after vaccination at 7-day intervals than after vaccination at 24-hour or 5-hour intervals. Titres fell to about the same level between 6 and 7 weeks after vaccination in all animals. The bactericidal activity of the serum rose sharply after vaccination to a maximum level between 5 and 9 days; this level did not differ significantly in animals inoculated at different intervals, and was maintained for at least 70 days (when agglutinin titres had fallen to near their original levels).

When groups of 20 mice inoculated with 3 doses of vaccine (250, 500 and 500 $\times$ 10^6 organisms) at 7-day, 24-hour and 5-hour intervals were challenged on the 12th day with "one lethal dose" of active organisms, survivals were 17 out of 18, 15 out of 17, and 11 out of 15 mice, respectively, only 1 out of 16 control mice surviving. [Deaths of mice during "the vaccination period" were 2, 3 and 5 for the groups receiving vaccine at 7-day, 24-hour and 5-hour intervals.] These results are taken as "indicating that a sufficient degree of immunity developed on vaccinating animals by any of the methods which we used".

R. S. F. Hennessey

AMOEBIASIS AND INTESTINAL PROTOZOAL INFECTIONS

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

ELSDON-DEW, R. **The Host-Parasite Relationship in Amoebiasis.** *South African Med. J.* 1958, Jan. 25, v. 32, No. 4, 89–92, 1 fig.

This paper was an address delivered to the South African Medical Congress at Durban in 1957. After some very wide generalizations, with examples, on host-parasite relationships of many kinds, there follows a discursive account of some of the unsolved problems of amoebiasis in this context. It contains no original matter. *A. R. D. Adams*

ALLEN, R. F. & WELLS, Gretchen. **The Treatment of Intestinal Amebiasis with Polybenzarsol.** *Antibiotic Med.* New York. 1957, Dec., v. 4, No. 12, 781–5.

Polybenzarsol is a polymer the chemical name of which is poly (methylene-4-hydroxybenzenearsonic acid). *In vitro* it is amoebicidal to

Entamoeba histolytica; it is non-toxic to animals. 53 patients with intestinal amoebiasis were treated [presumably orally] with polybenzarsol in doses of 250 or 500 mgm. (children or adults) thrice daily for 10 days. Stools were re-examined 10 days, a month and 3 months after the treatment; 47 (88·7%) of the patients on these examinations appeared to be cured of their infections. All those with symptoms were relieved of them during the first week of treatment, and usually within 48 hours. No undesirable side effects resulted from the treatment.

[For previous trials, see this *Bulletin*, 1955, v. 52, 45; 1957, v. 54, 1083.] *A. R. D. Adams*

RELAPSING FEVER AND OTHER SPIROCHAETOSES

MOOSER, H. Die Rückfallfieber. [**Relapsing Fever**] *Ergebn. Mikrobiol. Immunitätsf.* 1958, v. 31, 184–228. [Numerous refs.]

This is a useful summary of publications on relapsing fever from 1945 to 1956, compiled from the original papers and from abstracts in this *Bulletin*, the *Bulletin de l'Institut Pasteur* and *Excerpta Medica*; also *Global Epidemiology* and the *World Atlas of Epidemic Diseases*, and the *Rapports Epidemiologiques et Demographiques* published by WHO.

The author first considers louse-borne relapsing fever and discusses the great epidemic in French North Africa from 1943–1945, and that in Egypt in 1945 and 1946. Succeeding chapters deal with the disease in other parts of Africa, then in Asia, the Far East and Europe, respectively. Clinical symptoms and pathological anatomy, serology and immunology are followed by an account of experimental studies of *Spirochaeta recurrentis* during the epidemics from 1943 to 1946, including methods of culture of the spirochaete, and finally the treatment of epidemic relapsing fever.

The second part deals with relapsing fevers transmitted by various species of *Ornithodorus* and successive chapters are concerned with East African, Asiatic and Spanish-African relapsing fevers, then the Crocidura group, the American tick fevers, the prophylaxis of tick fevers, and finally treatment.

The third part—Miscellaneous—is largely devoted to a discussion of the development of spirochaetes in the intermediate host and the presence or absence of a negative phase. There are also a few isolated observations concerning the viability of spirochaetes, including a record by WEYER and MOOSER [this *Bulletin*, 1957, v. 54, 824] of *S. recurrentis* in infected lice, surviving for at least 387 days at −72°C. in sealed glass tubes. The review concludes with 8 pages of references.

Edward Hindle

ADDAMIANO, L. & BABUDIERI, B. **Research on Spirochaetal Strains isolated in Jordan.** *Bull. World Health Organization.* Geneva. 1957, v. 17, No. 3, 483–5.

The authors in Rome used a number of spirochaetal strains isolated from the blood of patients and also from ticks (*Ornithodorus tholozani*) in Jordan [this *Bulletin*, 1958, v. 55, 46], for the purpose of carrying out a series of laboratory studies. The first problem was whether the recrudescence of the febrile state and reappearance of spirochaetes in the blood after apparent clinical recovery are due to relapse or reinfection. It was found that spirochaetes could persist in the brains of mice for at least 50 days after disappearance from the blood stream but the period of survival was very variable. From these results it might be assumed that some of the recurrences in human patients are authentic relapses.

This does not exclude the possibility of reinfection and to test this cross-immunity experiments were made in mice with 4 strains of *Spirochaeta persicum* and the Itete strain of *S. duttoni* from ticks. After 20–40 days from the outbreak of the infection, the mice were treated with chloramphenicol succinate to get rid of any residual spirochaetes, and then reinoculated, half with a homologous strain and the other half with heterologous strains. The results showed that mice were immune against reinfection with homologous strains but were liable to infection with heterologous strains even from the same neighbourhood.

Two strains were found to give asymmetrical immunity; mice recovered from infection with the Irbid strain were protected against reinfection with the Husn strain, but those immune against the Husn strain were not protected against the Irbid strain. It would seem, from the results of these cross-immunity experiments, that the nomadic Bedouins are more likely to be reinfected than the more stable tribes.

A variety of drugs were tested on two strains of spirochaetes, including arsenobenzene; penicillin; streptomycin; chlortetracycline; oxytetracycline hydrochloride; tetracycline hydrochloride; and chloramphenicol. Penicillin was found to be more satisfactory from a therapeutic point of view than streptomycin or arsenobenzene but none of the three prevented relapses. Chloramphenicol had an immediate therapeutic effect but again did not prevent relapses. The most satisfactory drugs were found to be chlortetracycline (Lederle's Aureomycin) and oxytetracycline hydrochloride (Pfizer's Terramycin) and in spite of their high cost are recommended for the treatment of Jordanian tick-borne relapsing fever.

Edward Hindle

WALTON, G. A. **Observations on Biological Variation in *Ornithodoros moubata* (Murr.) (Argasidae) in East Africa.** *Bull. Entom. Res.* 1957, Dec., v. 48, Pt. 4, 669–710, 10 figs. [32 refs.]

The work reported in this paper began in 1948. *Ornithodorus moubata* was then generally accepted as a single biological entity commonly

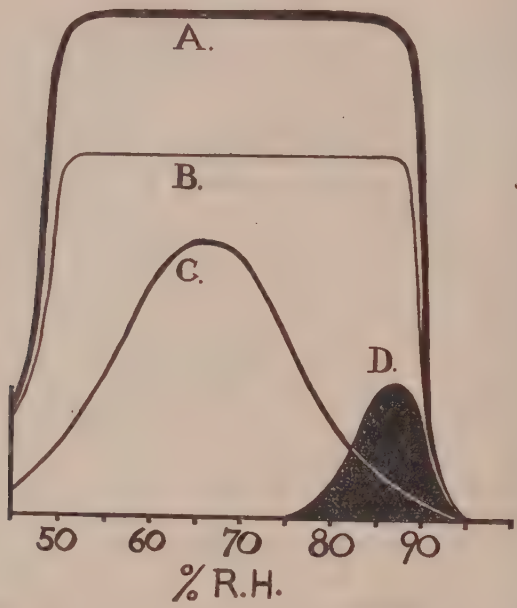
associated in urban conditions—camp sites, prisons, schools, rest houses and African hotels—with relapsing fever transmission to man. The true centres of infestation are now shown to be African tribal areas. In these, infested huts are numerous. Tribal custom and hygiene affect, however, this general pattern. Thus, Nilotic and Nilo-Hamitic tribes with good domestic standards are largely free from ticks while the poorer household hygiene of Bantu tribes is conducive to tick infestation.

The presence of ticks is not, however, consistently associated with relapsing fever. In certain Kenya highland areas (*e.g.*, Meru, Nyeri and the Taita Hills) relapsing fever is endemic, although ticks are relatively sparse in such "cool and wet" conditions. The tick micro-environment in the huts is given as a temperature range of 67° to 75°F. (mean 71°F.) [19·4°–23·9°C.: mean = 21·7°C.] and a relative humidity of about 86% (cobalt salt paper estimates in tick-infested crevices). Elsewhere in Kenya in "hot and dry" conditions (80°F. [26·7°C.] and about 55% to 60% relative humidity) ticks and relapsing fever are rare (lower altitudes of Embu district, foothills of the Taita Hills, and much of Kenya generally). A third set of circumstances is reported from the Kenya coast, in Digo district, where ticks are in parts very numerous but relapsing fever is anomalously infrequent. Here the ticks had micro-environmental conditions described as "hot and moist" (mean temperature 80°F. [26·7°C.] and relative humidity of 77%).

As regards Tanganyika, studies were made, particularly, in the area of the Usambara Mountains in the east and around the southern end of Lake Victoria in the west of the territory. Ticks are widespread, and numerous in huts, but the incidence of relapsing fever is lower than in Kenya. This is particularly noticeable as one proceeds from the cooler, wetter conditions of north-west Tanganyika, where the association of relapsing fever and tick incidences is almost as close as would be expected (not dissimilar from the endemic foci of the Kenya highlands generally), to the south-east where tick micro-environmental conditions become (again not dissimilar from much of Kenya) drier and warmer and the relationship of the disease and ticks is indefinite: in Tanganyika in the latter conditions ticks occur abundantly in huts, associated with a low incidence of human relapsing fever.

An important factor influencing tick densities in huts appeared to be chickens. Precipitin tests confirmed that in some parts of its distribution *O. moubata* is primarily a "chicken-eating form" (*e.g.*, in Digo district with 78% feeding on fowl and 18% on man) and in other parts it feeds preferably on man (*e.g.*, south-east of Lake Victoria with 73% feeding on man and 22% on fowl; or, 94% feeding on man, and 2% on fowl in the Kenya highlands and north-west Tanganyika). This is referred to as the "man-eating form". The man-feeders are more characteristic of cooler, wet climates; fowl-feeders are more typically associated with hotter conditions. Relative humidity (of the tick-infested crevices) appears to be more important than temperature in defining the biological

differentiation of these ticks. This is depicted graphically by the author as follows:



Hypothetical representation of the relative abundance of the "man-eating" and "chicken-eating" forms of *O. moubata* in huts with different values of microhabitat humidities. (A) "Chicken-eating form" in the presence of domestic fowls. (B) This represents the quantity of ticks obtained during a thorough search of a hut, the balance, shown in A above, remaining hidden in the walls of the huts. (C) "Chicken-eating form" in the absence of domestic fowls. The proportion obtained during a collection would be less, little more than shown for the "man-eating form" below. (D) "Man-eating form" in the presence and in the absence of fowls.

The predominantly "man-eating form" is, as can be seen, associated particularly with the higher incidences of relapsing fever. When, as occurs, large numbers of essentially "chicken-eaters" are present in huts a low incidence of human relapsing fever is understandable. Besides these two domestic forms of *O. moubata*, further information is given on the "wart-hog form" found in burrows of ant-bears and porcupines, commonly frequented by wart-hogs. It is still uncertain whether this form is introduced to domestic environments accidentally or plays any part in the natural history of human relapsing fever. Morphological differentiation of the three forms is not obvious; it has yet to be investigated intensively. A good deal of breeding and cross-mating of the forms has, however, been done. The man-feeder is least resistant and the wart-hog form most resistant to starvation. Survival without feeding (at 80% RH) of man- and of chicken-feeders fell off rapidly after 6–9 months, but no deaths occurred among the wart-hog form in

the first 2 years of starvation and about 70% still lived after 3 years of starvation. Egg production differs significantly in the three forms.

As regards general distribution of the 2 domestic forms, the man-feeder is thought to extend from the Atlantic shore of the southern Belgian Congo east to Lake Victoria, with isolated pockets in highland areas over East Africa to the Indian Ocean. The chicken-feeder extends from the level of the southern shores of Lake Victoria southwards into South Africa.

Numerous tables, charts, maps and a useful summary assist the reader to follow the author's analysis of about 7 years of field work in which, besides other aspects, nearly 5,000 huts were sampled quantitatively for *O. moubata*. Details of individual surveys are appearing in the *East African Medical Journal* [see, for example, this *Bulletin*, 1950, v. 47, 856; 1956, v. 53, 449]. The present paper offers an interpretation of the overall picture with special reference to the evidence for biological variants of *O. moubata* and the bearing of their distributions on the seemingly anomalous incidence of human tick-borne relapsing fever in relation to tick densities in African huts in Kenya and Tanganyika.

D. S. Bertram

YAWS AND OTHER TREPONEMATOSES

VAN DER HOFF, N. M. **Two Yaws Endemics in South-West Borneo.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1957, Sept., v. 9, No. 3, 281–90, 1 graph. [13 refs.]

The author contrasts the manifestations of yaws as it occurs among two distinct groups of people in South-West Borneo. The coastal area is inhabited by Malays and is separated by a swamp belt from the interior, which is inhabited by Dyaks. The two groups of people exhibit different modes of living but each group is relatively homogeneous. The following classification of yaws is used:—

Infectious types	(1) Mother yaw and polypapillomatosis (2) Localized papilloma (" wet crab yaws ")
Non-infectious types	(3) Palmar and plantar lesions (4) Other lesions.

Active yaws lesions were found in 698 of 3,966 (17·6%) Malays and in 523 of 1,959 (26·6%) Dyaks, but whereas infectious lesions were found in 56·8% of all yaws among the Malays, they were only 11·8% of the total yaws among the Dyaks.

The author deduces that the polypapillomatous stage must, on the average, last much longer at the coast. This he attributes to reinfection,

especially on the legs, probably through the agency of a fly of the family of *Chloropidae* (probably *Siphunculina funicola*, prevalent at the coast). The Malays live in close proximity to each other, thus favouring reinfection, whereas the Dyak lives near the forest with a greater spread of the population. It is assumed that reinfection among the Malays is frequent until the development of immunity is complete. The incidence of localized papillomata may in part be determined by occupational hazards but the infrequency of these lesions among the Dyaks is difficult to explain unless it is assumed that there is a difference in the strains of *Treponema pertenue* in the two districts.

In both areas the pattern of the disease has been largely uninfluenced by treatment but the author suggests that the Malays may suffer from a smaller number of late deformities by having passed through a florid stage at an earlier age than the Dyaks. *Frederick J. Wright*

See also p. 517, Davey, **Leprosy and Yaws: Points of Contact.**

LEPROSY

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Maroc Méd. 1957, Nov., v. 36, No. 390, 1007–236, numerous figs. [Numerous refs.] La lèpre. [**Symposium on Leprosy**]

This symposium on leprosy with special reference to Morocco is published under the scientific direction of R. Rollier, and contains 22 contributions. The papers are divided under 5 headings: prophylaxis and immunology; therapeutics; special aspects; bacteriology, biology and pathological anatomy; and leprosy in Morocco. An introduction stresses the importance of leprosy in Morocco, as more and more cases are discovered every year. The number found in 1953 of 100 rose to 222 in the first half of 1957. It is calculated that the known number of 3,000 really means an actual number of some 10,000.

The first paper, by J. A. Doull (pp. 1007–1014), asks the question: is it possible to eradicate leprosy? As infection is due to contact of healthy people with infectious patients and proportional to their infectiousness, it is justifiable to suppose that recent forms of treatment diminish the chances of spreading infection, although we have no absolute proof to that effect. Also, although we have no absolute proof that BCG creates

resistance to leprosy, it can do no harm and may do much good to vaccinate newborn infants exposed to leprosy infection. As the balance between the bacillus and the host is a fine one, it is possible that these measures may upset the balance in favour of the host so that the disease may gradually disappear.

N. Souza Campos (pp. 1015–1019) discusses the conditions which determine a positive lepromin reaction. Rotberg's "N Factor" is mentioned, those possessing this congenital factor being capable of developing resistance on contact with leprosy as shown by a positive lepromin reaction. But contact with tuberculosis and vaccination with BCG also raise resistance to leprosy, and have the power to convert a negative into a positive reaction. To what extent vaccination with lepromin antigen has itself a power of causing this conversion is not yet sufficiently demonstrated. E. Montestruc (pp. 1020–1024) stresses the particular susceptibility of children to leprosy and advocates the vaccination with BCG of all newborn infants in endemic countries, and also older children without reaction to tuberculin. A. Basset (pp. 1025–1029) also places confidence in BCG vaccination of the newborn, so as to cut off the continuity of leprosy from one generation to another.

Under the heading of therapeutics there are 7 papers. J. Gaté and J. Rousset (pp. 1033–1038) give a short résumé of the sulphones and their derivatives, with particular stress on DDS. They also mention isoniazid, PAS, thiosemicarbazones, but particularly recommend red sarsaparilla for use along with sulphones. M. F. Lechat (pp. 1039–1062) writes on the treatment of lepra reaction. After describing the condition in all its forms, he discusses no fewer than 19 different substances that have been used for its relief in recent years, in addition to other remedies which were formerly used. Corticotrophin and cortisone constitute the treatment of choice for "erythema nodosum". H. Floch and M. Mailloux (pp. 1063–1083) also write on sulphones and weigh up the relative values of DDS and its derivatives, oral and injection methods of administration, and the relative merits of various suspending agents. Among the advantages of recent forms of treatment he mentions how the leprosarium in French Guiana, which once had a very bad name for leprosy, now contains only a few negative cases and cripples, while children with non-infectious leprosy are able to continue their studies at the public school. N. P. Buu-Hoi (pp. 1084–1096) writes on new drugs for leprosy other than sulphones. He discusses the possible action of chaulmoogra derivatives and considers that this form of treatment may still be worth following up. He mentions the essence of citronella in cotton oil, and other cyclic terpenes. He then discusses the thiosemicarbazones and hydrazides, the N,N′-diarylthioureas and diaminodiphenyl-sulphoxide. Finally he makes suggestions of certain other substances which might be tried for possible antileprous properties. He considers that research should continue in the hope that an absolute solution may be found some day to leprosy infection. Colonel Laviron (pp. 1097–1105) describes his

method of mass treatment in French West Africa chiefly by injections at long but regular intervals of DDS suspended in chaulmoogra. There are 3 phases of treatment when the dosage of DDS is 600 mgm. once a week, then 1·25 gm. twice a month, and lastly 2 gm. once a month. R. Rollier (pp. 1106–1128) writes on the combination of red sarsaparilla with DDS and gives his experience with 73 cases of leprosy treated by this method, the former drug having the effect of diminishing the tendency to reaction produced by the latter. Photomicrographs are shown illustrating the histological changes which take place under this form of treatment. R. Rollier and E. Reboul (pp. 1129–1139) give a preliminary note on their trial of D-cycloserine in 6 cases of leprosy. Although it is still too soon to make a definite pronouncement as to its effectiveness, judging by the rapidity of its clinical action and the remarkable histological changes it may be of use in association with DDS, while it does not seem to have advantages over DDS by itself.

Under the section on special aspects of leprosy, F. Pelbois (pp. 1143–1146) deals with differential diagnosis. He finds very little in the literature on this subject, probably because most leprologists are not dermatologists. He proceeds to describe in the language of the dermatologist some of the early signs of leprosy.

J. Chenebault, J. Lepape and R. Rollier (pp. 1147–1162) make a radio-clinical study of lung changes in leprosy. The study was made in 847 patients in Morocco suffering from leprosy. They found that tuberculosis was 10 times more common among their leprosy patients than among a corresponding population without leprosy; that it was three times as frequent among males as among females; that it responds well to antituberculosis treatment; that it is more frequent in the lepromatous (2·72%) than in the tuberculoid (1·68%) type; that tuberculosis tends to continue for some years after leprosy in the same patient has been arrested; that pulmonary leprosy is very rare although some cases have been described by Jeanselme and by Nègre and Fontan, and the authors themselves had a patient with lung lesions and with sputum containing acid-fast bacilli which did not produce disease in guineapigs.

J. Roussy (pp. 1163–1176) writes on the radiological aspects of the bones of the extremities. His article is well illustrated with radiograms of the hands and feet, and the course of the disease in these parts is clearly explained.

Gallet and Durix (pp. 1177–1180) give a short article on ocular leprosy. Out of 500 leprosy patients examined they found the eyes involved in 102. Involvement of the cornea and conjunctiva was the most common, but affection of the iris had the gravest consequences for vision. In the great majority the leprous infection was considerably aggravated by trachoma. Want of facilities made it difficult to treat the more advanced cases adequately. A. Sarrola (pp. 1181–1184) gives his experiences in the treatment of ear, nose and throat conditions in leprosy. Of 514 patients, 361 were of the lepromatous type, that being the

commonest form of the disease in Morocco and the one in which ear, nose and throat lesions occur.

The next section deals with bacteriology, biology and pathological anatomy. M. Noury (pp. 1187–1193) makes a contribution on the leprosy bacillus. He describes a series of experiments beginning with the inoculation of a Moroccan with a leproma in 1946. Nodules taken from this patient were treated with sulphuric acid, sown on various media and inoculated into guineapigs and other animals. The subsequent stages of the experiment and the polymorphic organisms produced are described.

P. Bru and R. Rollier (pp. 1194–1205) tell of the results of puncture biopsies of the liver in 38 treated and untreated patients. Acid-fast bacilli were found in all except in one patient treated with DDS and Smilax, in one with the undifferentiated form and in 3 with the tuberculoid type. The question is raised whether it is not possible that a virulent form of the bacillus may persist in the viscera after the infection has been eliminated from the outer parts of the body.

R. Rollier and H. Planchet (pp. 1206–1212) deal with the interpretation of false positives in serological reactions. False syphilitic reactions in leprosy are inversely proportional to the albumin-globulin ratio, but are connected with the number, metabolism or destruction of leprosy bacilli in the body.

The remaining 3 papers deal with the history of leprosy in Morocco (E. Secret, pp. 1215–1220), leprosy in the ex-zone of Spanish Morocco (F. Contreras and M. Arce, pp. 1221–1231), and the survey and prophylaxis of leprosy in Morocco (N. Orusco, pp. 1232–1235). The disease is supposed to have been brought into the country by the Phoenicians about the year 1000 B.C. It has always been worse in the previous French zone than in the previous Spanish zone. *Ernest Muir*

Davey, T. F. **Leprosy and Yaws: Points of Contact.** *Bull. World Health Organization.* Geneva. 1957, v. 17, No. 3, 485-92, 8 figs. on 2 pls.

Leprosy and yaws have flourished side by side in past years in Eastern Nigeria. Though aetiologically different they have resemblances in clinical appearance, epidemiology and control. Atypical lesions of the two diseases may occur in the same patient and resemble each other closely. This occurs chiefly in the minor recurrent lesions of yaws, and the indeterminate leprosy lesions which are intermediate between the lepromatous and the tuberculoid types. In making the differential diagnosis, it is important to look for other present or previous signs of active yaws; and to examine the patient for such signs of leprosy as thickening of the ear lobes and anaesthesia of the hands and feet. In leprosy the Kahn reaction would ordinarily be negative, and on careful

examination lepra bacilli would be found. In tuberculoid leprosy there would be the immune response and signs of nerve involvement.

Keloid lesions resembling the scars of yaws are often found where caustics have been applied to leprous lesions. Erythematous framboesides can also resemble incipient lepromatous lesions, the differentiation being made by examining for bacilli. Healed gangosa resembles the sunken nose of leprosy. The leucoderma of yaws does not occur in leprosy, but the lepromatous involvement of the fingers resembles the ichthyotic condition of the backs of the hands in yaws. Mild contracture of the 4th and 5th fingers occurs in both diseases, and the condition in yaws may resemble the *main en griffe* of leprosy.

Epidemiologically the two diseases resemble each other most, as both are chronic and spread by contagion. Both are rural and connected with a low standard of living and hygiene. Both decline with the introduction of clothing. In both, children are more susceptible than adults and in certain places males are more susceptible than females, conjugal infection is rare, and congenital spread unknown. Both are associated with the tropics and show seasonal variations. *Ernest Muir*

Brown, J. A. K. & Stone, M. M. **Tuberculoid Leprosy in Identical Twins.** *Leprosy Review.* 1958, Jan., v. 29, No. 1, 53–5, 1 text fig. & 1 fig. on pl.

Identical twins are described, the only siblings out of a family of 9 who suffered from leprosy. The type was shown by biopsy to be tuberculoid. Investigation at the home showed that the father's mother had suffered from leprosy, probably lepromatous, but she died before the twins were born. A brother of the twins' father and a sister of the mother both had leprosy, but of the tuberculoid type. The average distance between dwellings in this part of Uganda is about half a mile. On an average one open case of leprosy can be found in every 5 square miles. The authors argue that "the simplest explanation is, therefore, that the twins derived their infection within the family by contact with an aunt and uncle, both of whom had tuberculoid disease". As only 2 out of 9 children were affected, and these were the identical twins, and as the disease was contracted only in a minority in the two previous generations "although all were exposed to a similar risk of infection", this example is regarded as confirmatory evidence of a constitutional factor [*cf.* Rotberg's "N Factor"] which is transmitted genetically, and which determines whether successful invasion will take place. *Ernest Muir*

Kooij, R. **Study of the Morphology of Mycobacteria leprae by Electron-microscopy.** *Leprosy Review.* 1958, Jan., v. 29, No. 1, 56–9, 16 figs. on 8 pls.

The bacilli were from leprosy lesions which had been excised and ground in a mortar with saline, and were freed from the tissue cells, proteins and debris by repeated centrifuging. The electro-micrographs were taken at ×36,000 magnification, some of them having been shadowed with tungsten oxide.

The author found the interpretation of the photographs difficult. Bacilli from untreated patients contained irregular arrangements of dense material, and those from patients treated with DDS, isoniazid or thiosemicarbazone were often swollen and transparent. Bacilli from patients with tuberculoid leprosy did not appear to differ from those with the lepromatous form of the disease.

One of the published photographs is of a globus and no limiting membrane is visible. The cause of the bacilli remaining in these clusters is discussed and the author maintains that his photographs are consistent with the view that the globus is a colony of bacilli bound together as a zoogloea. *S. R. M. Bushby*

WADE, H. W. **A Modification of the Fite Formaldehyde (Fite I) Method for staining Acid-Fast Bacilli in Paraffin Sections.** *Stain Technology.* 1957, Nov., v. 32, No. 6, 287–92. [14 refs.]

This method is essentially a combination of the 2 modifications of the technique described by FITE [*Bull. Hyg.*, 1938, v. 13, 1005].

The tissue is preferably fixed in Zenker fluid as the bacilli are held more firmly in position than with formalin fixation, and although no special recommendations are made for embedding the tissue, the author states that he habitually clears in thin cedar-wood oil. The reagent for removing the wax from the section is, however, important; xylene must be avoided as it lessens the acid-fastness of the bacilli, especially of the older ones such as may be present in leprotic tissue, and instead, immersion in 2 jars of a mixture of 2 parts rectified turpentine and 1 part liquid paraffin (heavy grade) is strongly recommended.

The bacilli are stained for 16–24 hours at room temperature with Fite fuchsin stain (magenta III, C.I. No. 678, 0·5 gm., phenol 5·0 gm., ethanol or methanol 10 ml. in distilled water to make 100 ml.). The sections are then washed and treated with 38–40% formaldehyde for 5 minutes; this treatment changes the colour of the bacilli to blue and it is important to use the reagent grade of formaldehyde. After further washing the section is decolorized by treatment with 5% sulphuric acid for 5 minutes (acid-alcohol loosens many of the bacilli by its turbulence), washed, immersed in 1% potassium permangate for 3 minutes, washed and then bleached in 2–5% oxalic acid for 30–60 seconds. The section is then counterstained with van Gieson stain. [Staining with haematoxylin is not recommended as it may mask the bacilli.] Dehydration is

rapidly accomplished with 95% alcohol and the sections are allowed to dry before being mounted in a synthetic mounting medium.

[See also this *Bulletin*, 1952, v. 49, 626.] *S. R. M. Bushby*

KINNEAR, A. A. & DAVISON, A. R. **Hormone Excretion and Liver Function in the Gynecomastia of Leprosy.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 110–18, 1 text fig. & 2 figs. on pl. [42 refs.]

A study was made to find out whether gynaecomastia in leprosy was in any way connected with hormone excretion or liver function. The study was made in 18 lepromatous patients with gynaecomastia, 20 lepromatous patients without gynaecomastia, 20 tuberculoid cases, and 20 normal Bantu controls.

The authors found that statistically there was little difference in liver function tests between the tuberculoid cases and the controls. There was a distinct sign of liver dysfunction in the lepromatous patients, but no significant difference between the usual lepromatous patients and those with gynaecomastia. The excretion of 17-ketosteroids was significantly less in the tuberculoid patients than in the normal controls; and it was also less in the lepromatous patients with and without gynaecomastia. There was no significant difference between the lepromatous patients with and without gynaecomastia in the excretion of gonadotrophins, or the oestrogens, though "mean estriol excretion in all the leprosy groups was significantly higher than normal".

It was concluded that no correlation could be found between gynaecomastia and liver dysfunction or oestrogen excretion. It is suggested that gynaecomastia in leprosy may be one of the disease entities of the Klinefelter-like syndrome, as this was found in 4 of the patients. Further work is contemplated to find out if a mammatrophic hormone is implicated in the gynaecomastia of leprosy. *Ernest Muir*

ROSS, Hilary & PETRIE, Isabel M. **Protein-Bound Iodine of the Blood Serum in Leprosy.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 122–5, 1 fig.

"Serum protein-bound iodine determinations were performed on sera from 120 patients with leprosy, of whom 96 had the lepromatous and 24 the tuberculoid type of the disease. As controls, 14 nonpatients were similarly examined.

"Of the 120 patients, 98, or 81·7 per cent, showed protein-bound iodine levels within the normal range. Elevated levels were found in 6 lepromatous patients and in 1 tuberculoid patient. Low levels were found in 11 lepromatous and in 4 tuberculoid patients.

"Abnormal values were found in 14 of the 91 patients on sulfone therapy, 7 having elevated PBI levels and 7 low levels."

COLLIER, W. A., BUENO DE MESQUITA, S. J. & VAN ZANTEN, E. **Quantitative Complement Fixation in the Different Forms of Leprosy.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1957, Dec., v. 9, No. 4, 345–56. [Numerous refs.]

The authors first review the various antigens that have been used in search for a workable complement-fixation test (CFT) in leprosy. All these have had the disadvantage that they have reacted with Wassermann-positive sera. The Essen antigen of Behring Works does not have this disadvantage. It is prepared from human *Myco. tuberculosis* cultivated on substrate 4 of Hohn and extracted repeatedly with alcohol. This antigen was tested quantitatively in 1,137 leprosy patients, in dilutions of 1 in 5·5 to 1 in 7·5 with sera in dilutions of 4 in 5, 2 in 5, 1 in 5 up to 1 in 320. The 4 in 5 reaction was considered negative, 2 in 5 to 1 in 10 positive, and 1 in 20 to 1 in 320 strongly positive.

It was found that lepromatous leprosy gave more positives than tuberculoid, and had higher titres of the complement-fixing antibodies. The level of titre and the frequency of positive reactions diminished as the disease diminished in lepromatous cases, and the same less distinctly in tuberculoid cases. The results with the lepromin test remained more constant. In lepromatous cases the Fernandez reaction was more often positive that the Mitsuda, while in tuberculoid cases and healthy people, as well as in tuberculosis patients, the Mitsuda reaction was more often positive than the Fernandez. In the nursing staff and in T_A and T_Q [nomenclature not explained] leprosy the two reactions were about equally frequent. In all cases combined, Mitsuda-positives were more frequent than Fernandez-positives.

The results are set out in detail in 28 tables. *Ernest Muir*

RHEINS, M. S., BIRKELAND, J. M., BURRELL, R. G. & GUINTO, R. S. **Hemagglutination and Lepromin Reactivity in Healthy Filipino Children.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 104–9. [12 refs.]

Haemagglutination and haemolysis tests, the techniques of which are described, were performed on sera of 135 schoolchildren living on Mactan Island, Cebu, an area endemic to leprosy. Later, these children along with others were tested with various concentrations of PPD tuberculin and with lepromin antigen. About 40% of the 135 sera contained haemagglutinating antibodies, while 85% of the subjects gave positive lepromin reactions. The positive lepromin reactions were probably due to previous infection with some mycobacterium. While the antibodies

detected by the Middlebrook-Dubos test for haemagglutination reside in the gamma globulin fraction, those which induce tuberculin hypersensitivity are associated with a new serum fraction " IV–10 ". " In view of these findings it might be of value to examine sera from healthy, tuberculin-negative children for tuberculoprotein antibodies and to correlate the results with lepromin activity." *Ernest Muir*

SOUZA CAMPOS, N. Indução da reatividade lepromínica por meio de testagem repetida. [**Induction of Reactivity to Lepromin by carrying out the Test Repeatedly**] [Editorial]. *Rev. Brasileira Leprologia.* S. Paulo. 1957, July–Sept., v. 25, No. 3, 167–207.

This is a symposium occasioned by an editorial in the *International Journal of Leprosy*, 1955, v. 23, 310. In this editorial Dr. WADE discusses the experience of IGNACIO and his associates [this *Bulletin*, 1956, v. 53, 1006] on findings after repeated lepromin tests carried out on children born in the Culion Leprosarium. Of the 50 children tested, at first only 11 (22%) were positive, and only 1 of them was 2 plus. No less than 37 (74%) reacted to the second test, and 11 were 2 plus. On the fourth test all had become positive, one-third of them had become 3 plus, and of the few that could not be brought above 2 plus by further testing none could be raised further by the use of BCG.

No fewer than 24 leprosy workers contribute to this symposium and give their own experiences from different points of view, some of them adding considerable subsidiary data. It is impossible to abstract each of these separately, but the author in summing up states that the great majority of those taking part in the symposium admit, with or without reservations, that the lepromin reaction is converted from negative to positive by inoculation and re-inoculation of Mitsuda antigen. On the other hand the majority of those who oppose this capacity of Mitsuda antigen are unable to doubt that BCG is a valuable auxiliary in the prophylaxis of leprosy. *Ernest Muir*

CAPURRO, E. T., ARAMBURU, N., SANCHEZ CABALLERO, H. & CABRERA, J. M. P. **Reversal of Negative Lepromin Reactions following Use of Tuberculosis Vaccine Irradiated.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 119–21.

The authors obtained in 39 of 50 subjects conversion from a negative to a positive lepromin reaction by injecting intramuscularly 0·5 to 1 mgm. of a vaccine prepared from a " virulent human strain of *Mycobacterium tuberculosis*, No. 199RB inactivated by ultraviolet irradiation ". 6 of these subjects had previously received BCG orally, but had remained

negative. Of the 11 who remained negative after this first inoculation 8 became positive after further inoculations of the vaccine.

Ernest Muir

HOLMES, W. J. **Leprosy of the Eye in South Korea.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 99–103.

The following is taken from the author's summary:—

"The author, an ophthalmologist, reports on a survey he conducted for the United Nations among leprosy patients in South Korea. He found pathologic lesions of the eyes and adnexae among 10 per cent of the patients examined. Concern is expressed over the lack of regular, continuous systemic treatment with sulfone drugs.

"The following recommendations are offered: Prescription of corrective eye glasses where needed. Sun glasses in instances for relief from glare. . . . For inflammation of the uveal tract, local instillation of 0·4–1·5 per cent cortisone eyedrops, along with a conventional mydriatic such as 1 per cent atropine.

"For deforming and disabling lesions of the eyelids and eyes, judicious eye surgery within the confines of the settlements themselves is recommended. It is suggested that a competent travelling ophthalmic team could effectively handle the majority of leprous eye lesions that require surgical intervention."

MUKHERJI, A. **Effect of X-Ray Irradiation on Excised Earlobe Specimens from Cases of Lepromatous Leprosy.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 147–9.

The author applied X-rays to tissues cut from the ears of lepromatous patients. A deep X-ray therapy plant working at 150 KVP was used, with a copper filter. The materials were placed at a distance of 150 cm. from the source of rays and were irradiated for 15 minutes on 3 or 4 successive days. Smears were made after each exposure, and showed diminution in numbers of bacilli after the second considerable diminution after the third day, and nothing but a trace of the bacilli after the fourth day. The bacilli were beaded or disintegrated, but the tissue cells showed no damage.

The author considers that these results are due to the mild application of X-rays over a longer period, resulting in a differential action on the bacilli as compared with the cells. "The findings in sections, comparing the nonirradiated control specimens with those that had received the full X-ray treatments, were in agreement with the findings in smears so far as concerns the numbers of bacilli. The tissue cells of the irradiated lesions showed no damage from that treatment."

Ernest Muir

DAVEY, T. F. **The Treatment of Leprosy with Diphenyl Thiourea Compound SU 1906 (DPT). A Report on Expanded Trials in Nigeria. I. A Second Report on the Progress of the Pilot Trial with a Review of the Findings in Expanded Trials.** *Leprosy Review.* 1958, Jan., v. 29, No. 1, 25–36, 1 fig.

This is the author's second report on trials with 4 butoxy-4′dimethylaminodiphenyl thiourea, commonly known as SU 1906 or, for short, DPT [see this *Bulletin*, 1956, v. 53, 1435]. The 16 months since the former report have been used to test therapeutic activity in larger numbers of lepromatous patients, to test its usefulness where response to sulphones is unsatisfactory, and to explore its value in combination with other drugs.

Trials were made in 167 patients, 97 of these being at the original centre, and 70 others spread over 6 other centres in Nigeria. The drug was administered orally in 0·5 gm. tablets, the daily dose rising from 1 to 4 tablets by fortnightly increases for adults, while 1 to 3 tablets was the maintenance dose for children, varying according to age. In these doses the drug is well tolerated without gastro-intestinal irritation, dermatitis, drug fever, disturbance of bone-marrow or liver. It is well tolerated in patients hypersensitive to sulphones and thiosemicarbazone, and promotes a feeling of tranquillity and well-being. "It has in fact not been necessary at any centre to remove any patient from treatment with DPT for any cause." Thiourea and its compounds are known to have an antithyroid action and, in larger doses, to cause skin irritation; but in the doses given with this derivative no such side effects were found.

The improvement with DPT has been found at least equal to that with DDS controls, and even a little better. The slowing down of improvement after the first 9 months, as mentioned in the previous report, proved to be only temporary, and, though bacteriological improvement becomes slower after the initial improvement, clinical improvement continues unimpaired and infiltration continues to diminish, as shown by RIDLEY's method [*ibid.*, 1957, v. 54, 833]. Erythema nodosum, neuritis and exacerbation are all less than in sulphone treatment. DPT is of particular value in treatment of special cases. In 3 patients with hypersensitivity to both sulphones and thiosemicarbazone entirely satisfactory results were obtained with DPT, and "no case of drug sensitivity to DPT has been encountered yet in Nigeria". 3 patients with psychosis have tolerated DPT much better than DDS. 7 patients with persistent erythema nodosum under DDS tolerated DPT without difficulty. Patients with severe neuritis occurring either before treatment or during DDS treatment have made more tranquil and satisfactory improvement under DPT. Twice-weekly treatment with DPT, at a maximum dose of 4 gm., has been tried; this "appears to involve some loss of efficiency of the drug, though results in some patients may be entirely satisfactory".

Combined treatment with DDS and DPT was still found to give freedom from toxicity and, during the first year, results superior to those with DDS alone; but longer trial on larger numbers of patients is required before the full advantage of this combined treatment can be better assessed. A combination of DPT with isoniazid gave differing results at the various centres, in some better results being given than with full doses of DPT alone, and in others less good results.

DPT, in spite of its outstanding advantages, is not as yet suitable for certain situations, both on account of the greater expense and because of the more frequent administration necessary.

The results obtained at the other 6 centres where DPT was tried are reported separately at the end of this article. *Ernest Muir*

RIDLEY, D. S. **Therapeutic Trials in Leprosy using Serial Biopsies.** *Leprosy Review.* 1958, Jan., v. 29, No. 1, 45–52.

Now that many drugs are being tested for their therapeutic efficacy in leprosy it is important to have an accurate method with a mathematical basis for assessing improvement. Clinical impressions of progress are subjective, and photographs are not amenable to statistical analysis. The various bacteriological indices have no mathematical basis which can be used for accurate comparison; they reflect the density of the bacilli but not the size of the lesion. The author's method, which was described in a previous article [this *Bulletin*, 1957, v. 54, 833], consists in taking serial biopsies at 3- or 6-month intervals, 1 or 2 biopsies being taken on each occasion. The density of bacilli is estimated according to the number of bacilli in a 1/12 in. objective field in the terms of 6-plus down to 1-plus. An estimated 1,000 bacilli in a field is reckoned as 6-plus, 100 bacilli as 5-plus, 10 bacilli or more as 4-plus, 1 bacillus or more as 3-plus, 1 bacillus or more in 10 fields as 2-plus, and 1 bacillus or more in 100 fields as 1-plus. The bacillary (or biopsy) index is arrived at by multiplying the above findings by the fraction of the section occupied by leprous granuloma. "This fraction is estimated by observation of a haematoxylin-eosin section under a low power magnification: a 1½ inch (32 mm.) objective is ideal; by considering whether the granuloma occupies much more or much less than one quarter, half or three-quarters of the dermis, it is possible to estimate the fraction to the nearest 1/10 with fairly good agreement between different observers."

The mean of the rates of progress of 14 cases observed by serial biopsies for at least a year is shown in a table, and is approximately 25·3%. "The expected improvement factor obtained by this system for sulphones is constant at all stages of treatment because acquired resistance to these drugs by *M. leprae* is a rare event. This may not be so with other drugs." The author sees no necessity for taking both smears and biopsies; ". . . biopsies are the most useful method of assessing progress until the patient is nearly better: thereafter multiple

smears are needed as a test of cure ". He considers that his technique of serial skin biopsies, as fully described in this article, offers the best method available at present for estimating the activity of antileprous drugs; with its use it should be possible to assess a new drug effectively with fewer patients and over a shorter period. *Ernest Muir*

DAVISON, A. R. & KOOIJ, R. **Is Erythema Nodosum Leprosum a Favorable Occurrence?** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 91–8, 1 text fig. & 3 figs. on pl.

This experiment was planned to determine whether or not erythema nodosum leprosum (ENL), occurring during the treatment of lepromatous leprosy, influences the time required for the elimination of the bacilli. Two series of patients were chosen: 225 who had already been on treatment for 32 months, and 117 treated for 24 months. These two series were again subdivided into two groups: those who had shown ENL before or during treatment (142 in the first series and 58 in the second); and those without ENL (83 in the first series and 59 in the second).

Comparing the average bacteriological index before treatment with that after treatment, the authors found that " bacilli took longer to be eliminated in the ENL groups than in the others ". Out of 74 ENL patients the average period before negativity was 72 months, while out of 23 patients without ENL the average period was 57 months. It is mentioned, however, and illustrated by a text-figure, that the ENL patients were considerably worse bacteriologically than the non-ENL patients at the beginning of treatment. The degree of ENL and its effect on the length of period before negativity is also shown in months, the average period for mild ENL being 74 months, for moderate ENL 72 months, and for severe ENL 76 months. The conclusion arrived at is that " ENL is *not* a favorable sign ". *Ernest Muir*

MCKENNA, W. B. & CHALMERS, A. C. **Agranulocytosis following Dapsone Therapy.** [Memoranda.] *Brit. Med. J.* 1958, Feb. 8, 324–5. [17 refs.]

In 1950 ESTEVES and BRANDÃO (*Trab. Soc. Port. Dermat.*, 1950, v. 8, 209) drew attention to the beneficial results of dapsone in the treatment of dermatitis herpetiformis, and since then several observers have confirmed their findings. Details are given of a patient suffering from this disease, in whom this treatment was used. She was given a daily dose of 50 mgm. of dapsone, rising to 100 mgm. daily after a week. After 4 weeks of treatment she developed an " influenza-like illness ". Two weeks later a diagnosis of agranulocytosis was made, the white blood cells being 1,500 per cmm., and the polymorphs and eosinophils zero. The dapsone was stopped, and 500,000 units of crystalline penicillin given

every 6 hours for the next 2 weeks, along with one transfusion of 2 pints of fresh whole blood. By the 18th day the patient had fully recovered, the white blood cell count had risen to 8,800 per cmm., the polymorphs to 4,488 and the eosinophils to 88.

[This case confirms what has been recorded by numerous leprosy workers: that there is danger in raising the dose of dapsone too rapidly or too high, especially when the patient is suffering from an accompanying depressant disease.] *Ernest Muir*

Ross, C. M. **Leprosy Control in the Northern Region of Nigeria.** *Leprosy Review.* 1958, Jan., v. 29, No 1, 17–24, 2 charts.

An account is given of the method adopted for the control of leprosy in the Northern Region of Nigeria by supplying out-patient treatment in clinics within reach of all the patients within the region. The population is about 18 million, but its density varies much from 304 per square mile in Kano to as little as 25 per square mile in the Niger Province. Sample surveys show a general incidence of leprosy of about 35 per thousand, but the incidence rises to as much as 100 in places.

In a poor country like Nigeria, segregation of patients in leprosaria would be too costly, and in any case very few patients would willingly submit to this. Patients are, however, willing to attend clinics. To begin with, 10,000 patients were registered at 51 treatment centres which were conducted by trained leprosy workers and based on existing leprosy settlements. It soon became evident that this would not bring leprosy under control, and it was decided to base treatment on Local Authority and Government dispensaries, the dispensary attendants being trained to carry out treatment under the supervision of the Rural Medical Officer. "In Provinces where 200 to 500 cases were treated at great or considerable expense for some years in settlement and segregation villages, 10,000 to 15,000 are being treated in a province at a fraction of the cost and with good results." Attendants are taught to treat the patient according to the type, age and physical condition, and they are not allowed to give more than 4 tablets weekly of DDS. A Leprosy Assistant based on a Local Authority dispensary can visit 3 or 4 branch clinics and give treatment there each week. The whole scheme is under the supervision of 2 European medical specialists. Encouraging results are obtained. *Ernest Muir*

Bergel, M. Inoculación del *Mycobacterium leprae* a ratas alimentadas con dietas prooxidantes. III. A) Resultados bacteriológicos hasta los cinco meses de la segunda reinoculación. [**Inoculation of** *Mycobacterium leprae* **in Rats fed on a Prooxidant Diet. III. (A) Bacteriological Results up to Five Months after the Second Reinoculation**]

Semana Méd. 1957, Dec. 26, v. 111, No. 26, 1313–16, 4 figs. English summary. B) Especificidad biológica de los bacilos ácidorresistentes hallados a los siete meses de la segunda reinoculación. [**(B) Biological Specificity of the Acid-fast Bacilli found in the Seventh Month after the Second Reinoculation**] *Ibid.*, 1316–18. English summary (9 lines).

This is the third article published on this series of experiments [see this *Bulletin*, 1958, v. 55, 172], in which rats fed on prooxidant diet (poor in vitamin E and containing linseed oil) showed multiplication of acid-fast bacilli 7 months after inoculation in the right testicle of a suspension of *Myco. leprae*. Inoculation of material from the first series of rats produced similar results in a second series of rats fed on the same diet, and likewise the same multiplication was found in a third series of rats inoculated with bacilliferous material from the second series. In all three series control rats fed on normal diet, and similarly inoculated with *Myco. leprae*, failed to show any multiplication of acid-fast bacilli.

The results in the third series are described in the present article. A rat, killed 60 days after inoculation into the right testicle of material from the second series of rats, showed a very few scattered bacilli. A rat killed on the 108th day showed the presence of acid-fast bacilli and globi. Some bacilli were thin and apparently newly formed. The bacilli were much more numerous than in the previous rat. In a rat killed on the 150th day the testicles were not diminished in size and showed no outward changes. Biopsy material from the right testicle was divided into 2 parts, one part being inoculated into fresh rats. The rest of the material was examined and showed large numbers of globi with bacilli single and in bunches, both intra- and extracellular. The isolated bacilli were short or long, perfectly homogeneous, thin, equally stained, and straight. Occasionally they had an acid-fast spot in their interior. The globi, both those inside and those outside cells, were composed of homogeneous bacilli. There were also bacillary masses with enormous quantities of bacilli, distributed here and there, and forming large ovals or irregular figures. There were also some masses of less acid-fast bacilli, giving the impression that they were pre-acid-fast elements.

In all the series of experiments the control rats fed on ordinary diet failed to show any multiplication of bacilli.

The author considers the possibility of the multiplying bacilli being other forms of mycobacteria, such as *Myco. tuberculosis*, *Myco. ulcerans*, the bacilli of rat leprosy, paratuberculosis or Johne; but there are strong arguments against all of these. He therefore concludes that the microorganisms found in this third passage through rats fed on this particular diet are Hansen's bacilli, and he believes that this is the first time that they have been cultivated *in vivo* outside the human body.

Ernest Muir

NAGUIB, M. & ROBSON, J. M. **The Infectivity of *M. leprae murium* kept for Various Periods on the Bench and in the Refrigerator.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 126–9.

"*M. leprae murium* in a Tween-saline suspension stored for 1 to 6 days, and in lepromatous tissue kept for 1, 2 and 3 weeks, whether on the bench or in the refrigerator, remained alive and were capable of producing infection. This was also true of a suspension prepared from the 3-week-old leproma and heated for 2 hours at 60°C. before inoculation, although the latent period was greatly prolonged. These materials were tested by intracorneal inoculation in mice."

[See this *Bulletin*, 1953, v. 50, 1149; 1955, v. 52, 1100; 1957, v. 54, 178.]

CHANG, Y. T. **Chemotherapy of Murine Leprosy. VI. The Effects of Isonicotinylhydrazone of 2-Carboxymethoxy-3-Methoxybenzaldehyde (Compound 373) and Isonicotinylhydrazone of 2-Carboxymethoxybenzaldehyde (Compound 377) on Mouse Leprosy.** *Internat. J. Leprosy.* New Orleans. 1957, Apr.–June, v. 25, No. 2, 130–46, 4 text figs. & 12 figs. on 3 pls. [28 refs.]

"The activity of isoniazid, isonicotinylhydrazone of 2-carboxymethoxy-3-methoxybenzaldehyde (Compound 373), and isonicotinylhydrazone of 2-carboxymethoxybenzaldehyde (Compound 377) was compared, in equimolar doses, in mice infected intraperitoneally with *M. leprae murium*.

"All three compounds were found to be highly effective in the suppression of the murine leprosy infection in the three-months experiment. They were most effective when treatment was started immediately after inoculation and continued for three months, and proportionally less effective when treatment was delayed for one month and then continued for two months. The degree of activity of the three compounds was more or less equal.

"When mice were treated for three months and allowed to live, all three compounds suppressed the infection for a period; then the disease remanifested itself, killing the animals. The suppressive activity of isoniazid and Compound 373 was similar, while that of Compound 377 was the highest.

"When mice were treated with either isoniazid or Compound 373 continuously for 15 months from the time of inoculation, the survival time was definitely longer than when they were treated for only three months. Eventually, however, the infection led to death regardless of the duration of treatment. Isoniazid revealed activity similar to that of Compound 373.

"On the other hand, the continuous administration of Compound 377 for 15 months suppressed the infection in the majority of the mice. This appears to be the first drug to hold this infection in check for as long as 15 months."

HELMINTHIASIS

In this section abstracts are arranged as far as possible in the following order:—TREMATODES (*schistosomes, other flukes*); CESTODES (*Diphyllobothrium, Taenia, Echinococcus, other cestodes*); NEMATODES (*Hookworms, Ascaris, Filarial worms, Dracunculus, etc., Trichuris, Enterobius, Trichinella, etc.*).

SANDOSHAM, A. A. **Malaysian Parasites—XXXII. Infection of Animals by Major Groups of Helminths: an Interim Tabulation.** *Studies from Inst. Med. Res. Federation of Malaya.* 1957, No. 28, 403–8.

Helminths found in animals collected by the Colonial Office Scrub Typhus Research Unit in Malaya were previously reported [this *Bulletin*, 1955, v. 52, (167)]. Nearly 3,000 animals have now been examined, and this paper revises and amplifies the previous records. The environments, feeding habits and mode of life of the hosts are correlated broadly with the parasite patterns. *W. E. Kershaw*

SWARTZWELDER, J. C., FRYE, W. W., MUHLEISEN, J. P., MILLER, J. H., LAMPERT, R., PEÑA CHAVARRIA, A., ABADIE, S. H., ANTHONY, S. O. & SAPPENFIELD, R. W. **Dithiazanine, an Effective Broad-Spectrum Anthelmintic. Results of Therapy of Trichuriasis, Strongyloidiasis, Enterobiasis, Ascariasis, and Hookworm Infection.** *J. Amer. Med. Ass.* 1957, Dec. 21, v. 165, No. 16, 2063–7.

The authors present experimental evidence which shows that Dithiazanine (3-ethyl-2-[5-(3-ethyl-2-benzothiazolinylidene)-1,3,pentadienyl] benzothiazolium iodide), the chemical formula of which is briefly described, is, in proper dosage, effective against *Trichuris trichiura, Strongyloides stercoralis, Ascaris lumbricoides* and *Enterobius vermicularis* and has a significant action on *Necator americanus*. The drug was supplied by Eli Lilly & Co. The authors' results were as follows.

Trichuriasis. The authors treated 214 adult patients weighing over 90 lb., of whom 164 had light to moderate infections with *T. trichiura* without severe diarrhoea or dysentery, with 200 mgm. of Dithiazanine given 3 times a day for 1, 2, 3 and 5 days. Stools were examined before, during and after treatment. Treatment for 1 day cured 3% of the 164 infected patients; for 2 days 24%; for 3 days 77%; for 5 days 97%. The percentage reductions of the egg counts in patients with worm burdens large enough to allow computation were: after 1 day of treatment, 52%; after 2 days, 88%; after 3 days, 99%; after 5 days, 100%. This shows the value of the drug for mass treatment lasting 2 or 3 days. Large numbers of whipworms were passed out; these were usually flaccid and they did not become motile after rinsing in distilled water and incubation at 37°C. The worms were coloured light greenish-blue by the drug, as were also the eggs of *T. trichiura* and *A. lumbricoides*,

though this did not prevent the embryonation of the eggs of either species. The lives of severely ill persons may be saved. One emaciated, dehydrated child, unconscious after prolonged diarrhoea, with an egg count of 412,800 eggs per ml., passed, during treatment with crushed Dithiazanine tablets given first by stomach tube and later by swallowing, 3,162 adult *T. trichuria*; "complete reversal of the initial unfavorable prognosis" followed. The final dosage selected for trichuriasis was 20 mgm. per lb. body weight, with a maximum daily dose of 600 mgm., given in divided doses 3 times a day. Light to moderate infections are treated thus for 5 days; for severe infections treatment for up to 10 days may be needed.

Ascariasis. The authors treated 42 patients, aged 2 to 65, most of whom were heavily infected with *A. lumbricoides*. 35 weighed less than 50 lb. Most of them were given, for 5 days, 10 mgm. per lb. body weight of Dithiazanine twice a day up to a maximum of 300 mgm. twice a day, or 200 mgm. 3 times a day. The infection was completely eliminated from 28 of these 42 patients. The only side effect seen was vomiting, usually only once, in 20% of the patients. Urinalyses showed no significant change. Both immature and mature ascarids were passed out and these were flaccid and immotile, and coloured light greenish-blue but, unlike the trichurids, they regained their motility when they were rinsed in distilled water and incubated at 37°C.

Strongyloidiasis. None of the large number of drugs previously tested by the authors cured this infection, but Dithiazanine eliminated it from 89% of 18 adult males treated for up to 21 days. The criteria of cure were rigid; they included examinations of a series of stools by several techniques and of duodenal drainage fluid obtained after treatment. In 259 (98·5%) of 264 stools examined after treatment no larvae of *S. stercoralis* could be found. Out of 52 duodenal drainages done on the 18 patients during and after treatment no larvae were found in 47 (90%). When rats infected with *S. ratti* were treated, 100% were cured. For human strongyloidiasis the usual dose was 200 mgm. in enteric-coated tablets given 3 times daily for 21 days. Side reactions were mild, infrequent and transient.

Enterobiasis. To 20 boys, aged 8 to 13 years, infected with *E. vermicularis* 200 mgm. of Dithiazanine in enteric-coated tablets were given 3 times a day after meals for 5 days. It was concluded that all these patients had been cured. Later 15 boys were given 100 mgm. of Dithiazanine 3 times a day for 5 days and 7 negative swabs taken after treatment showed that 100% had been cured, even by this reduced dose. Occasional vomiting was the only side effect observed.

Hookworm. After treatment of 39 patients lightly infected with hookworm with 200 mgm. of Dithiazanine 3 times a day for 3 to 5 days, no hookworm eggs were found in the stools of 23 of these patients examined by the formalin-ether technique. In most of the other patients hookworm eggs could only be found by concentration methods.

To 8 patients with heavy hookworm infections 200 mgm. of Dithiazanine were given 3 times a day for 10 days. Table 3 shows that in 6 of these patients the egg counts which varied before treatment from 15,600 to 94,700 eggs per ml., showed a 65% reduction. Of the hookworms recovered from the stools 99% were *Necator americanus*. In spite of anaemia, heart disease, malnutrition and nephrosis the patients tolerated the drug well. Later 22 heavily infected and anaemic children and adults were given a combination of 600 mgm. of Dithiazanine and 1 gm. (for children) or 2 gm. (for adults) of tetrachlorethylene on 2 or 3 alternate or successive days. In 8 of these patients the treatment was repeated after 10 days. The hookworm infections were completely eliminated from 36·3% of the patients and in the others the percentage reduction of the egg count was 97%.

Most of the patients had multiple infections with the helminths named.

An outstanding feature of the drug is its lack of side effects. One child, aged 3, weighing 40 lb., accidentally took, all at once, 14 tablets of Dithiazanine (a total of 1·4 gm.); the child was not ill and had no complaints and no vomiting occurred. The stools were coloured by the drug but the urine was not. One pregnant patient (7½ months), with a haemoglobin level of 4 gm. per 100 cc. and a moderate whipworm infection and massive hookworm and *Ascaris* infections, was given 600 mgm. of Dithiazanine daily for 10 days without any sign of intolerance and adults given the same dose for 3 weeks showed no significant changes in blood urea nitrogen, urine, haemogram, bilirubin, zinc-lipid-thymol turbidities, alkaline phosphatase values or prothrombin time, and the urine of children treated showed no discoloration or other abnormality.

[See also this *Bulletin*, 1958, v. 55, 436.] *G. Lapage*

Janz, G. J. & de Carvalho, A. M. Subsídios para o conhecimento das bilharzioses em Angola. [**Studies on Schistosomiasis in Angola**] *Anais Inst. Med. Trop.* Lisbon. 1956, Dec., v. 13, No. 4, 597–613, 2 maps. [14 refs.] English summary.

An account is given of the incidence of schistosomiasis in Angola. Although *Schistosoma haematobium* is widespread throughout the territory *S. mansoni* is almost unknown, only a few small foci on the eastern border of the country have been identified. *S. haematobium* infections are said to be benign in Angola and are usually only identified in patients who have reported for treatment for some other complaint.

No statistically significant differences were found between groups of people with malaria and intestinal parasites in addition to schistosomiasis and those without schistosomiasis. An investigation attempting to correlate diet and susceptibility to schistosome infection failed to produce any conclusive results.

The geographical incidence of *S. haematobium* is shown to be most

intense in the coastal plain in the neighbourhood of Luanda and on the plateau in the south in Huila province. No differences due to age or sex exclusively could be found in the people infected. An infection rate of 78·1% with *S. bovis* in cattle at the Bom Jesus ranch is recorded; examination of goats, sheep and pigs gave negative results.

The data on intermediate molluscan hosts are a little confused, but the conclusion reached is that the principal hosts for *S. haematobium* are *Bulinus* (*Physopsis*) *globosus* and *B.* (*P.*) *africanus* with a very low infection rate (1%) found in a species of *Bulinus* (*Pyrgophysa*). [On the map this species is tentatively marked as *B. senegalensis*, but the abstracter has been fortunate in being able to examine specimens and there is little doubt that it is *Bulinus crystallinus* (Morelet).]

C. A. Wright

McCullough, F. S. **The Seasonal Density of Populations of** *Bulinus* (*Physopsis*) *globosus* **and** *B. forskalii* **in Natural Habitats in Ghana.** *Ann. Trop. Med. & Parasit.* 1957, Sept., v. 51, No. 3, 235–48, 1 map & 8 figs. [13 refs.]

To observe the fluctuation in population density, collections of *Bulinus* (*Physopsis*) *globosus* and *B. forskali* were made at fortnightly intervals in 4 selected habitats at Pokoasi, near Accra, Ghana. The habitats were selected either for similarity or direct contrast in their seasonal conditions. Habitats 1 and 2 were 12-metre stretches along the banks of a small dam built across the River Nsaki. Habitat 3 was a small pool immediately below the spillway of the dam. Habitat 4 was a small pond close to the river about half a mile downstream from the dam. The level of water in the dam remained more or less constant throughout the year. The pool below the spillway was either stagnant, as in the period of drought, or strongly flushed during the rains. The downstream pond was stagnant during drought but was frequently flooded from the river during the rains.

The fluctuation in numbers of *B.* (*Physopsis*) *globosus* collected at different periods of the year was broadly similar in the 4 habitats in spite of the variation in conditions that prevailed during this time. High counts were made at the beginning of the dry season in December and January while very few snails were found in March and April after severe flooding during the rains. After prolonged drought the reduction of snails in habitats 1 and 2 appeared to be correlated with the development of water-fern (*Azolla* sp.) which crowded out the water-lily and rendered conditions unsuitable for the snails. In habitat 3, flushing after rains was the most important factor influencing the survival of snails, and low counts were recorded after each seasonal flooding. Stagnation during drought also appeared to reduce the number of snails. In habitat 4 drought was the main factor influencing snail numbers, but it was noted that the population density built up rapidly once the pond became flooded

during the rains. Analysis, in terms of age, of the numbers of snails collected showed that the density of young snails (shell less than 5 mm. wide) did not follow the same pattern as that for the total snails collected, and it is suggested that different optimal conditions may be necessary at different stages of snail development.

Collections of *B. forskali* showed marked differences in distribution of this species in the 4 habitats. Very few were found in habitats 1, 2 and 4 while they were relatively abundant in habitat 3—that exposed to severe flushing—which was least favourable for *B.* (*P.*) *globosus*. While it is admitted that the observations made do not provide satisfactory conclusions concerning the behaviour of *B. forskali* there can be little doubt that the ecological requirements of this species are very different from those of *B.* (*P.*) *globosus*.

From the observations made, tentative suggestions are provided concerning the use of molluscicides for snail control. It is suggested that 3 treatments should be given; the first in December, and the second in January to destroy the snails when their density is greatest and the third in March or April to kill the small number of snails that survived the earlier treatments. *O. D. Standen*

LIETAR, J. Biologie et écologie des mollusques vecteurs de bilharziose à Jadotville. [**Biology and Ecology of Snail Vectors of Schistosomiasis in Jadotville, Belgian Congo**] *Ann. Soc. Belge de Méd. Trop.* 1956, Dec. 31, v. 36, No. 6 *bis*, 919–1036, 13 graphs, 9 charts, 1 folding map & 13 figs. on 3 pls. [41 refs.]

This extensive study of the molluscan vectors of schistosomiasis in the Jadotville region of the Belgian Congo is concerned with their biology and ecology and the development of control measures through the use of molluscicides, physical interference with the environment of the snails and the predatory habits of snail-eating fish.

The chapters preceding the account of factual observations and experimental work by the author deal with general opinions relating to the importance of schistosomiasis in Africa, the endemicity of the disease in the Jadotville area and the physical, hydrographic and climatic characters of the region. This section of the work is a compilation of data presented in the works of others which formed the essential basis of the present study.

The vectors of human schistosomiasis were found to be *Biomphalaria pfeifferi* and *Bulinus* (*Physopsis*) *africanus*. The most widespread mollusc, *Lymnaea natalensis*, was also included in the study on account of its important role as vector of fluke diseases of cattle. During the 2-year period of investigation some 100,000 planorbids, more than 75,000 *Physopsis* and nearly 150,000 *Lymnaea* were collected and examined. These collections were made systematically during the course of the

various seasons from 53 different localities scattered through the regional hydrographic system.

It was found that the density of the snail population was markedly influenced by the alternation of dry and rainy seasons and that the periodicity of fluctuation was different in running and stagnant waters. Thus, in running water the maximum snail population was found to occur at the end of the dry season but in stagnant waters the peak was reached towards the end of the rainy season. Under optimum conditions for development, the snail population was found to increase 5 or 6 times. Although the annual cycle of variation in population density fell into a broad common pattern, the three species under study were seen to present certain differences from each other. *Lymnaea* commenced its population increase towards the end of the rainy season and declined well before the end of the dry season. The determining factors that appeared to be associated with this development were high oxygen tension of the water and an abundant growth of fresh aquatic vegetation. *B. pfeifferi* commenced proliferation 1 or 2 months later than *Lymnaea*. This appeared to be associated with the falling off of rapid flushes of the streams as the dry season approached and the more even rate of water flow which facilitated the deposition of coarse vegetable detritus that provided the most favourable conditions for the development of these snails. The onset of the first floods of the succeeding rainy season rapidly terminated these conditions and reduced the snail population accordingly.

Physopsis was found to be the slowest to take advantage of the onset of what appeared to be favourable conditions. For these snails it appears necessary that the aquatic flow should develop and start to decline to the point where deposition of fine organic detritus may provide the most suitable conditions for development. The slow speed of the water permits the sedimentation of such material in the marginal regions of the waterways which provide suitable breeding places. As distinct from *Lymnaea*, *Physopsis* was found to reproduce best under water conditions of low oxygen tension caused by heat and decay.

Broadly, the fluctuation in snail population was of the same order during both years of study but in certain locations the proportions of the species were found to vary considerably. Each species of mollusc appeared to thrive best in its own characteristic environmental conditions but within the limits of these conditions imposed by seasonal influence it was generally the case that egg-laying was most prevalent in the early part of the dry season and at a minimum during the heavy rains.

The regional over-all infection rate of the snails with brevifurcocercous cercariae was greatest with *B. pfeifferi* at 6·0 to 7·5% and least in *B.* (*P.*) *africanus* at about 0·5%. However, in spite of this wide difference in infection rates the incidence of schistosomiasis in the African population was about 50% with the intestinal and urinary forms in much the same proportion. Schistosome cercariae were found in adult snails only.

With *B. pfeifferi*, the main dry season of April–May preceded the main peak of infection in June and the short dry season in January preceded a subsidiary peak in February. *Physopsis* exhibited a less regular annual infection cycle. This may have its explanation in the need for certain necessary ecological conditions and not only in the presence of the vectors in an endemic area. The evidence suggests that *Physopsis* is more susceptible to fluke infections other than schistosomes and that the infection rate is relative to the abundance of the mollusc.

The most encouraging results of chemical molluscicide action were obtained with the use of sawdust impregnated with copper sulphate. The treated sawdust was scattered in the streams where a proportion of the copper sulphate was converted to copper hydroxide which settled on the stream beds and on all submerged objects. Almost complete elimination of snails could be achieved by this method but the egg masses were resistant to treatment and thus necessitated a further application of molluscicide a few weeks later in order to destroy the newly hatched molluscs. The microflora and microfauna were largely destroyed but fish were not greatly affected. Sodium pentachlorophenate was effective only in slow streams with steep banks. The physical approach to snail destruction was by means of artificial flushing of streams following damming and subsequent release of the accumulated water. This was effective against all snails except *Lymnaea*. In the latter, such operations merely served to simulate the optimum conditions for development. In several experiments in biological control with the fish, *Tilapia chrystii*, considerable reduction in snail density was achieved.

While the whole of this long paper is of interest, the chapters on the biology, ecology and destruction of the snails will be found most rewarding to those working in other areas and the detailed information should be read in the original. *O. D. Standen*

VERMEIL, C., with the technical collaboration of D. GHARBI. Etat actuel des recherches schistosomo-malacologiques en Tunisie—données expérimentales. [**Present Position of Research on Snail Vectors of Schistosomiasis in Tunisia. Experimental Data**] *Arch. Inst. Pasteur de Tunis*. 1957, Dec., v. 34, No. 4, 525–9.

CRIDLAND, C. C. **Ecological Factors affecting the Numbers of Snails in Permanent Bodies of Water.** *J. Trop. Med. & Hyg.* 1957, Oct., v. 60, No. 10, 250–6, 2 figs.

Investigations were undertaken to determine the fluctuations that occur in the population densities of *Biomphalaria adowensis adowensis*, *B. sudanica sudanica*, *Bulinus forskali* and *Lymnaea natalensis caillaudi* in a permanent pond in the neighbourhood of Jinja, Uganda. The pond was of 3 to 4 acres in extent and up to 10 feet in depth. Observations

were carried out for 19 months, from the beginning of August 1954 to the end of February 1956. *B. s. sudanica* was not present in the pool itself but in a shaded ditch connected with it. The sampling area in the dam was of 135 feet of the margin where the depth of water varied from 12 to 18 inches. Sampling was carried out once a month by two assistants working for one hour over this area. When the number of snails collected was too few for determination of trematode infection rates, collections were made from an adjacent area to bring the total up to 100. Where the number of snails from the sampling area exceeded 50 in the 7–5 mm. group or 25 in the less than 5 mm. groups no additional material was collected and these snails alone were used for assessment of infection rates. *B. s. sudanica* were sampled from 45 feet of the drainage ditch.

B. a. adowensis and *B. s. sudanica* showed very similar seasonal fluctuation in population density. This consisted chiefly of a peak in October and maximum depression in March–June. The long rains in April stimulated regeneration which built up gradually over the next 6 months. The fall in numbers between November and May 1954 was attributed, at least in part, to the effects of parasitism, for it was during this period that the highest incidence occurred.

The seasonal fluctuation of *B. forskali* was not as marked as with the *Biomphalaria* spp. although a well-defined peak of density occurred in November 1954 and December 1955. Only a small number of the snails were infected with trematodes and this is considered too small to have influenced the decline in numbers from November to July.

Lymnaea natalensis caillaudi was found to provide peak density in July–August. This species is highly susceptible to parasitism and the marked fall in population density between July and October coincided with a high incidence of trematode infection. While there appeared to be correlation between infection and subsequent reduction in snail density with the *Biomphalaria* and *Lymnaea* species a similar fluctuation occurred in *B. forskali* where trematode infection was largely absent. Parasitism is thought to play some part in reducing populations but the onset of senescence must be included as a possibility. *O. D. Standen*

CRIDLAND, C. C. **Ecological Factors affecting the Numbers of Snails in Temporary Bodies of Water.** *J. Trop. Med. & Hyg.* 1957, Dec., v. 60, No. 12, 287–93, 3 figs.

Collections of *Bulinus* (*Physopsis*) *nasutus*, *Lymnaea natalensis caillaudi* and *Bulinus forskali* were made from a temporary drainage ditch to determine the seasonal fluctuation in population density. The investigation was made over a period of 18 months. During this time the longest period in which the ditch held water was 133 days and the longest dry period was 69 days. Sampling was made with a hand net and the snails collected were returned next day to the collecting place.

During dry periods, samples of soil were examined and all snails found were measured and dissected. For determination of infection rate, snails were collected from a larger area adjacent to the sampling area used for assessment of seasonal fluctuation. These were subjected to the standard method of stimulation by light for shedding of cercariae.

With all three species the onset of drought conditions markedly reduced the snail population. The mortality rate among *B.* (*P.*) *nasutus* was very high and at the end of the dry season very few living snails were found. Some snails of considerable size range appeared a few hours after the ditch was flooded and it is concluded that these had survived a period of aestivation during drought. Observations made at the time the ditch dried out showed that *B.* (*P.*) *nasutus* dug themselves into the edges of the ditch. Of 30 snails found aestivating none showed incidence of trematode infection when dissected. High density of snail population occurred in August 1954, again in May and October 1955. Between August 1954 and the drying out of the ditch in the following October the snail density decreased, but at the same time the trematode infection rate increased from 42% to 80%. It is suggested that this decrease in population was directly connected with the degree of parasitism on account of inability of infected snails to breed, and to mortality due to this cause. No parasitized snails survived aestivation in either of the periods of drought.

With *L. natalensis caillaudi* none of the snails survived the November–January drought. The population reached its peak in September 1954 but showed a marked fall in October, immediately preceding drought. This species showed a high incidence of trematode infection, reaching 92% in September 1954 and 94% in the following October.

No *B. forskali* were found during the first 7 months of the investigation. Their appearance in the rainy season in February 1955 was followed by an increase in population until the onset of the dry season 4 months later. Few were found aestivating during this time but the occurrence of snails after the drought indicated that some successful aestivation must have occurred. No *B. forskali* were found infected during the course of the investigation.

Survival rates during aestivation were investigated by experiment with *B.* (*P.*) *nasutus*, *L. natalensis caillaudi* and *Biomphalaria sudanica tanganikana*. 50 normal and 50 infected snails of each species were placed in a naturalized concrete pond. The snails were segregated so that a partition separated the infected from non-infected specimens. The pond was left to dry out over a period of about a month, during which time the temperature fluctuated between 28°C. and 30°C. One month after drying out the pond was flooded and the surviving snails collected and removed. Uninfected *B.* (*P.*) *nasutus* aestivated successfully but no infected snails survived. The uninfected snails established a new generation but the infected snails did not. None of the original *Lymnaea* survived, although some second generation snails produced before the

pond dried were alive after the period of drought. It is suggested that immature snails of this species are more resistant to drought. A few uninfected *Biomphalaria* and one infected specimen survived the aestivation period. The uninfected snails re-established themselves quickly but the infected snails did not.

Laboratory experiments with normal *Biomphalaria pfeifferi* and those experimentally infected with *Schistosoma mansoni* showed that after an aestivation period of 9 days 44 of 50 normal snails and 2 of 50 infected snails survived. In another group examined after 15 days' desiccation, 6 of 50 normal snails and no infected snails were alive.

It is generally concluded that of the species of snails examined both in the field and in the laboratory it is unlikely that infected specimens survive a protracted period of drought. *O. D. Standen*

CRIDLAND, C. C. **Ecological Factors affecting the Numbers of Snails in a Permanent Stream.** *J. Trop. Med. & Hyg.* 1958, Jan., v. 61, No. 1, 16–20, 3 figs.

Previous papers have dealt with the fluctuation of snail population density in a permanent pond and a temporary ditch [see above]. A continuation of Cridland's malacological observations in Uganda is contained in this paper which relates to the fluctuation of snail density in a permanent stream. The species of snails under observation were *Biomphalaria sudanica tanganikana* and *Lymnaea exserta*. Monthly snail collections were made, during 21 months, from the Kibibi River in the Busoga district. The stream was about 4 feet wide and 6 to 8 inches deep. Sampling was carried out in 15 feet of stream by means of a hand net.

With *B. s. tanganikana* only snails from the sampling area were used to determine the general trematode infection rate, but collections were made from an adjacent area to provide snails for determination of the *Schistosoma mansoni* infection rate. Laboratory white mice were exposed to cercarial infection to prove the identity of *S. mansoni*. Where necessary the collection of *Lymnaea* from the sampling area was supplemented by adjacent collection for determination of the infection rate.

The *Biomphalaria* population density increased from July to October 1954 due mainly to the presence of young snails. The adult population showed only minor fluctuations throughout the year and the decrease in population during the months of November to April was accounted for by a recession in the numbers of young snails collected. In 1955 the seasonal increase commenced in May, following the onset of rains in April. In both years the infection rate varied considerably. No infected snails were found in August to October 1954, January, February, July, October and November 1955. In each year the highest infection rates (4–16%) occurred in December. Infection of *B. s. tanganikana* with *S. mansoni* was proven by experimental infection of mice and was

remarkably constant except for the months July to October 1954, when no snails were found infected with *S. mansoni*.

With *Lymnaea exserta* the population density was at its highest in July to September in each year, but although the presence of young snails contributed to this period of high density the proportion of adult snails also was highest at this time. The onset of rains in April stimulated the production of new generations until October, when a decrease occurred. This infection rate was fairly constant within different age-groups throughout the period of observation but was directly proportional to the age of the snail. In adult snails the infection rate varied between 20 and 58% except for October 1954 when it rose to 76%.

O. D. Standen

GILLMAN, T. **Venous Obstruction in the Pathogenesis of Hepatic Bilharziasis. A Preliminary Report of Comparative Findings in Rats, Monkeys and Man.** *Ann. Trop. Med. & Parasit.* 1957, Dec., v. 51, No. 4, 409–16, 11 figs. on 2 pls. [15 refs.]

This paper, illustrated by good photographs and photomicrographs, is of very considerable interest both for the information it contains and the light it throws on a difficult subject. Not least in interest are the logical implications of successful treatment of the parasitic infection. The author gives the following excellent summary:—

"1. During the course of a study of the possible co-carcinogenic action on the liver of bilharzial hepatic lesions and carcinogenic dyes, some interesting findings were made relating to the pathogenesis of bilharzial cirrhosis.

"2. Findings in experimentally infected monkeys and rats, as well as in naturally infected human subjects, indicate that:

"(*i*) Isolated bilharzial pseudo-tubercles around the eggs do not, *per se*, cause hepatic cirrhosis or even extensive hepatic damage.

"(*ii*) Bilharzial cirrhosis may perhaps be the end-result of progressive obstruction of intrahepatic portal radicles induced by endo- and peri-phlebitis evoked by ova and, more especially, by dead worms. Contracture of the scar tissue formed in such phlebitic lesions may eventually be the cause of gradual obstruction of the large portal veins in the liver, of consequent progressive death of liver tissue, and ultimately of the pipe-stem cirrhosis characteristic of bilharzial hepatic infections.

"(*iii*) Dead worms create more vigorous and much more extensive reactions than the eggs, and are therefore probably more important than ova as pathogenic agents.

"3. The absence of cirrhosis and splenic changes in the rat, despite gross liver damage, and the early appearance in monkeys of splenic changes indicative of portal hypertension, may be attributable to basic differences in the micro-anatomy of the intrahepatic portal radicles in the two species and in man.

"4. It is suggested that, as has been shown by SHAW and GHAREEB [this *Bulletin*, 1938, v. 35, 665] in the case of the lung, the hepatic and alimentary, and perhaps even the urinary, lesions in bilharziasis may be the outcome of obstruction of veins and other tube-like structures (e.g., ureters) consequent on contracture of intra- and peri-venous scar tissue evoked both by bilharzia ova and, more especially, by dead worms.

"5. Some suggestions are made to account for the apparently striking differences in the severity of the pathology and morbidity due to alimentary bilharziasis in Egyptians and in Africans, despite the high incidence of infestation in both peoples. The variations between them in mode, severity and frequency of infection, which result in the incidence in Egyptians of greater numbers of spontaneously dying highly pathogenic (dead) worms, may be the basic reason for such differences.

"6. On the basis of these findings it is suggested that, if the dead worms are as actively pathogenic as they would seem to be, an apparent 'cure' of the clinical signs and symptoms of bilharziasis effected by killing the worms with antischistosomal drugs may be deceptive. Cirrhosis of the liver induced by dead worms, as well as progressively obstructive fibrotic lesions elsewhere, may be the aftermath of such clinical 'cures' months or even years later. Should this view prove to be correct, a new orientation may be necessary to the therapy of alimentary bilharziasis and perhaps of other forms of the disease." *A. R. D. Adams*

WILLIAMS, A. W. **Cor Pulmonale in Schistosomiasis.** *East African Med. J.* 1958, Jan., v. 35, No. 1, 1–5, 3 figs.

"A case of fatal cor pulmonale from pulmonary schistosomiasis is reported. The infection was contracted in a part of Uganda where little clinical schistosomiasis occurs."

SHAFEI, A. Z. **Clinical Trials of a New Synthetic Compound for Treatment of Bilharziasis.** A Preliminary Report. *J. Trop. Med. & Hyg.* 1958, Jan., v. 61, No. 1, 12–16. [11 refs.]

The compound is the hydrochloride of 1-B-diethylamino-ethylamino-4,6,8 trimethyl-5-azathioxanthone (Preparation 17581). It is thus similar to lucanthone (Miracil). It has shown marked therapeutic activity for experimental schistosomiasis in mice. The trials were carried out on patients with *Schistosoma haematobium* infection at Alexandria.

30 patients of Group A received 10–15·6 mgm./kgm. daily for 10 days (total dose 100 mgm./kgm.); 30 patients of Group B received 8·3–12·5 mgm./kgm. daily for 21–24 days (total dose 175–262 mgm./kgm.). Toxic effects on the circulatory system were not important. Gastro-intestinal disturbance occurred in 40–47% of the patients. Some arthralgia and rheumatoid myalgia occurred in 6 patients. Insomnia occurred in 3

patients and severe headache in 7; vertigo, pallor and general weakness occurred in 2 patients, and treatment was therefore discontinued; 13–20% of the patients passed granular casts in the urine indicating some toxic action on the kidneys. Other systems of the body did not show toxic effects. The urine of patients was examined weekly for 2 months after treatment. At the start all patients were passing viable ova in the urine; 60% of Group A and 47% of Group B ceased passing living ova after 6–8 days of treatment. After 2 months 33% of Group A and 25% of Group B were still free from ova.

Apparently this compound has moderate therapeutic activity in human schistosomiasis and it has similar side effects to other Miracil compounds.

F. Hawking

SMITHERS, S. R. **The Occurrence of** *Schistosoma mansoni* **in the Gambia.** *Ann. Trop. Med. & Parasit.* 1957, Dec., v. 51, No. 4, 359–63, 1 map.

Recent surveys of schistosomiasis in the Gambia [this *Bulletin*, 1955, v. 52, 169 *bis*; 1956, v. 53, 1438] have not detected *Schistosoma mansoni* although the existence of a potential vector, *Biomphalaria pfeifferi gaudi*, has been recorded. In the present investigation snails of this species were found in the Allahein River some 25 miles south of Bathurst, and some of them were found to be discharging mammalian schistosome cercariae which, when applied to white mice, produced *S. mansoni* infections. Examination by concentration methods of stools from the inhabitants of Jiborah, the nearest village, revealed *S. mansoni* ova in 11 of 21 children aged 7 to 16 years and 19 of 21 adults aged 20 to 40 years. This is the first record of *S. mansoni* in the Gambia. The infected persons showed no clinical signs clearly referable to schistosomiasis. Urinary schistosomiasis was not found though the vector, *Bulinus jousseaumei*, was present. A brief account is given of the local epidemiology and the ecology of *B. pfeifferi gaudi*. 11 infected children were also found among 52 examined in 3 neighbouring villages. It is suggested that other undiscovered foci of *S. mansoni* may exist in Senegambia but that the disease is unlikely to be widespread because of the restricted ecological requirements of the vector. *T. H. Davey*

PIMENTEL, D. & WHITE, P. C., Jr. **Geographic Distribution of** *Australorbis glabratus*, **the Snail Intermediate Host of** *Schistosoma mansoni* **in Puerto Rico.** *Amer. J. Trop. Med. & Hyg.* 1957, Nov., v. 6, No. 6, 1087–96, 2 figs.

An investigation was undertaken in Puerto Rico to determine the ecological distribution of *Australorbis glabratus* and its relationship to *Schistosoma mansoni* infection. Environments of diverse types exist for the snails on the island and the rainfall varies markedly. Collections

were made in 421 catching stations and snail infection rates were based on dissections from 73 stations.

The findings indicated that large bodies of standing water were unsuitable for this species, whereas small ponds and all types of running water and their associated marshes could provide abundant snails. Rivers of a steep gradient flushed the snails away, but those of low gradients, especially when contaminated with sewage, usually contained numerous snails. Drainage and irrigation canals, though excellent habitats, were rarely infested because they were usually free of sewage. [These findings confirm those already reported by HARRY and CUMBIE (see this *Bulletin*, 1957, v. 54, 308).] In regard to physiographic conditions, snails and schistosomiasis were mainly associated with deposits of alluvium. In small inland alluvial deposits the snails were sometimes flushed out by run-off from the surrounding steep slopes, but generally they provided excellent habitats because both man and snails were crowded in the small river valleys.

The third most important factor influencing snail distribution was rainfall, an even distribution being more important than the amount. The snail was absent from areas of concentrated heavy rainfall and from arid areas with 30 to 45 inches of rain annually. Regions with 45 to 60 inches of rain were suitable if other factors were favourable.

The incidence of infection of snails and man with *S. mansoni* was correlated with snail density and sewage contamination of the water courses and the various ways in which man exposed himself to infection.

T. H. Davey

CHERNIN, E. **A Method of Securing Bacteriologically Sterile Snails** (*Australorbis glabratus*). *Proc. Soc. Exper. Biol & Med.* 1957, Oct., v. 96, No. 1, 204–10, 3 figs.

Bacteriologically sterile newly hatched *Australorbis glabratus* were obtained in the following manner. Handling solution (HS) and a modified handling solution (HS(M)) were used in all operations. HS was a simple chemical solution containing NaCl, 2·0; KCl, 0·1; Na_2HPO_4 (anh), 0·05; $MgSO_4.7H_2O$, 0·2; $CaCl_2.2H_2O$, 0·1; all as gm. per litre, and phenol red 0·4% solution, 0·5 ml. per 100 ml. HS. HS(M) was prepared by adding sterile $NaHCO_3$, 1·0–2·0 ml. of 1·4% aqueous stock solution per 100 ml. of sterile HS, and penicillin G (dryst. pot.) and streptomycin sulphate (100 units and μgm. respectively per ml. HS). The disinfecting solution was 5·25% sodium hypochlorite solution diluted to 1:100 with HS.

Mature egg masses were dissected in HS, to which 0·2% Triton N-100 had been added, to separate the individual egg capsules. The detergent facilitated dissection and also served to kill various micro-organisms on the surface of the capsules and any embryo snails in punctured capsules. The egg capsules were transferred to sterile vessels containing HS with

hypochlorite where they were left for 10–15 minutes. Three washes were given with sterile HS(M) and the egg capsules were transferred individually and aseptically to tubes containing sterile HS(M). These tubes were maintained at 28°C. in an upright position and examined in a similar manner to tissue culture roller tubes. Sterility rates were obtained by transference of egg or hatched snail and medium to thioglycollate medium. Aliquots of the remaining HS were inoculated into nutrient broth, blood-agar slopes and Sabouraud's dextrose agar slope. Tests were made at 28–32°C. for 10 days and at room temperature for a further 21 days.

In a series where 340 eggs were treated and tubed 86% hatched and only 3% of hatched snails or unhatched eggs were contaminated.

A 50% survival rate in terms of days after hatch showed no significant variation in length or survival time although snails in HS(M) plus glucose tended to live slightly longer. In the groups examined, all 50% end-points fell between 15 and 20 days. Mortality was low during the first 10 days but increased rapidly thereafter. Maximum survival time ranged from 21 to 29 days.

Variable success was obtained in similar experiments with other snails. *Biomphalaria pfeifferi* gave much the same results as *A. glabratus* but experiments with *Lymnaea* spp. and *Marisa cornuarietis* were not equally successful.

It is concluded that the development of a technique based on experience of hatching several thousand bacteriologically sterile snails provides opportunity for study of metabolic and nutritional characteristics, study of *in vitro* culture of snail tissues and the influence of microbial or viral agents of possible value in snail control. *O. D. Standen*

ROWAN, W. B. **A Simple Device for determining Population Density of *Schistosoma mansoni* Cercariae in Infected Waters.** [Research Notes.] *J. Parasitology.* 1957, Dec., v. 43, No. 6, 696–7.

An apparatus for sampling large volumes of water for the presence of schistosome cercariae is described. It consists, essentially, of the simple modification of a 4-quart aluminium pressure cooker so converted that it becomes a pressure filtration chamber. The original should be consulted for details but the principle of this apparatus is that water containing cercariae is forced through a filter paper and the cercariae, together with silt, are retained on the paper. After being washed with clean water, the filter paper is removed and treated in a pan with 0·5% ninhydrin reagent. The filter paper is dried in the pan over a spirit stove and is then ready for reading. Such readings may be made in the field with a lens, or more critical examinations may be made. Accurate cercarial counts are made in the laboratory by drawing parallel lines across the paper, placing the paper on a glass plate and saturating with xylol containing excess sodium bicarbonate; examination with a binocular

microscope shows the cercariae as dark blue with reddish acetabulum against the translucent paper. It is claimed that *Schistosoma mansoni* cercariae may be differentiated from other furcocercous cercariae.

In 10 trials 100 *S. mansoni* cercariae were added at the intake to water samples of different turbidities (2–16 p.p.m.). Paper counts showed a recovery of an average of 64 ± 14 cercariae with an average of 45 ± 8 recognizable as *S. mansoni*. Some 200 tests have been made in typical streams and rivers in Puerto Rico and will form the subject of a separate report.

When the turbidity of the water is such that the filter paper is clogged before the test sample is through, the latter may be treated with filter alum to flocculate the suspended matter without affecting the usefulness of the sample. In 20 trials involving the flocculation technique the recovery rate for the 100 added cercariae was about 36%, with about 23% recognizable as *S. mansoni*. *O. D. Standen*

OKPALA, I. **Histopathological Studies on** *Schistosoma mansoni* **Infection in Snails** (*Australorbis glabratus*). *West African Med. J.* 1957, Dec., v. 6 (n.s.), No. 4, 153–63, 11 figs.

MICHELSON, E. H. **Studies on the Biological Control of Schistosome-Bearing Snails. Predators and Parasites of Fresh-Water Mollusca: a Review of the Literature.** *Parasitology.* 1957, Dec., v. 47, Nos. 3/4, 413–26. [Numerous refs.]

The author has reviewed more than 600 references to material pertinent to ecological systems where information may be obtained concerning the nature of organisms predatory or parasitic upon molluscs.

The collated information is summarized under the group headings of Microbial Agents, Flatworms and Nematodes, Annelids, Rotifers, Arthropods, Molluscs, Amphibians and Reptiles, Fish, Birds and Mammals. The microbial agents are separated into Algae, Fungi, Bacteria and Protozoa. It was found that relevant information was both scanty and diffuse. The review of microbial agents includes references that range from the parasitism (as distinct from commensalism) of clams with *Chlorella vulgaris*, to a fungus (*Catenaria*), spirochaetes, the reputed virulence of *Bacillus pinotti* to *Australorbis glabratus*, and the parasitic nature of ciliates and flagellates.

The parasitic relationship of digenetic trematodes to molluscs is not reviewed because of its obvious character and vast literature. Only meagre information is available concerning the relationships of planarians and nematodes to molluscs. The leeches constitute the main predators among the annelids while one species of rotifer, *Proales gigantea* is known as a parasite of the eggs of pulmonates.

Parasites of molluscs are known among insects, arachnids and crustacea; the cannibalistic character of molluscs is little known. Among the amphibians, certain frogs and toads are known to be predators of molluscs but little is known of reptiles in this connexion. The fish provide a reasonably wide range of predators and numerous control measures have been put forward. Birds, especially water fowl, are known to include molluscs in their diet but the number of species that feed exclusively on such material is small. The mammals constitute no threat to molluscan populations.

In comment, the author asserts that although the purpose of the review was to ascertain which organisms or groups might provide indications for further investigation concerning possible agents for biological control of molluscs of medical importance, the information obtained was of little assistance. " . . . it would appear that the groups of mammals, amphibians, reptiles and birds probably offer the least fruitful areas for further study. No general statement can be hazarded with regard to the remaining groups except, perhaps, to focus attention on the bacteria, fungi, and viruses—if for no other reason than that they have received essentially no attention thus far." *O. D. Standen*

KUNTZ, R. E. **Relationship of Temperature to Molluscicidal Activity.** *Amer. J. Trop. Med. & Hyg.* 1957, Sept., v. 6, No. 5, 940–45, 1 fig.

Experiments to establish the relationship of temperature to the efficiency of molluscicides were carried out in naturalized porcelain bath tubs sunk to ground level and exposed to seasonal variation in temperature as prevailing near Cairo. 6 tubs were used and 4 tests were made in each tub weekly for a period of about 2 years. 2 of the tubs were heated by submerged heating units. 50 *Biomphalaria boissyi* were added to each tub and the molluscicides were added to provide a concentration of 3 p.p.m. The chemicals used were dinitro-o-cyclohexylphenol (DCHP), sodium pentachlorophenate (NPCP) and copper sulphate. Temperatures were recorded twice daily in one heated and one non-heated tub. Snails were removed from test-tubs at the end of 24 hours' exposure and after rinsing twice in clean water were transferred to aerated pond water. Observations and records of deaths were made during the following day.

The results of these tests showed that in the unheated tubs the molluscicidal effect was greatest during the summer months when the natural temperature was at its highest and that the activity was increased in the heated tubs. The curves for seasonal mortality rates in both types of test were roughly parallel to the seasonal temperature curves. All three molluscicides showed the same pattern of activity related to temperature, with DCHP providing the highest and $CuSO_4$ the lowest efficiency at the 3 p.p.m. concentration level.

The results of these tests were paralleled by results of field trials previously reported [this *Bulletin*, 1952, v. 49, 973; 1956, v. 53, 1441].

It is concluded that the influence of temperature should be taken into account when planning programmes of snail control by molluscicides.

O. D. Standen

PESSÔA, S. B. & AMORIM, J. P. Notas de campo sôbre moluscocidas. [**Field Notes on Molluscicides**] *Rev. Brasileira Med.* Rio de Janeiro. 1957, Aug., v. 14, No. 8, 552–6. English summary.

The concern of the authors of this paper has been the eradication of snails in pools near to living places in North-East Brazil. They rightly regard such pools as the most dangerous foci for transmission of *Schistosoma mansoni*. The paper describes a number of experiments in which cheap and readily available molluscicides were used. In closed pools good results were obtained with a mixture of 6 parts of pitch and 4 parts of Gammexane dissolved in 2 parts of kerosene, the mixture being dispersed in sand and applied to give a final dilution of about 30 gm. of pitch to the square metre of water surface. For 8 weeks after application the pool was free of live snails and the authors suggest that the deposition of pitch on the aquatic plants dispenses with the need for removing these before treatment and that there is a possibility that the presence of pitch in the mud of the pool will render it permanently unsuitable for colonization by *Australorbis glabratus*. A further advantage is that the pitch prevents children from swimming and exposing themselves to infection but does not prevent the water from being used for horticultural purposes. Experiments were also made confirming the usefulness of copper carbonate as a molluscicide and showing that in flowing water the efficiency of copper sulphate was increased by the addition of Gammexane. The authors advocate the use of copper carbonate in open wells used as drinking places by cattle and suggest that experiments with crude petroleum might provide evidence of another cheap molluscicide.

[The value of all of these experiments would have been greatly enhanced if the authors had carried out longer follow-up observations after chemical treatment.]

C. A. Wright

FRAGA DE AZEVEDO, J. & GOMES, F. C. Estudo da eficácia e modo de acção de alguns moluscocidas (Nota prévia). [**Efficacy and Mode of Action of Certain Molluscicides**] *Anais Inst. Med. Trop.* Lisbon. 1956, Dec., v. 13, No. 4, 579–87, 9 figs. on 5 pls. English summary (5 lines).

A series of experiments to investigate the efficiency of 6 molluscicides are described. The compounds tested were Tetramide A; 2 methyl-1, 4 naphthoquinone; 2,3,4,6-tetrachlorophenol; pentachlorophenol; cyclohexane 8 and copper sulphate. The compounds were used in 3 dilutions each, 20, 10 and 5 parts per million. The results are tabulated in the paper.

The experimental techniques employed leave a good deal to be desired. The tests were carried out in crystallizing dishes and only 15 snails per dish were used. In some experiments the snails used were *Physa acuta* and in others *Helisoma duryi* but no assessment of the relative susceptibility of these two species to any one compound was made.

The investigation on the mode of action of the compounds tested consisted simply of an histological examination of the tissues of killed snails. The conclusion reached was that all of the molluscicides had a generally toxic effect on the whole snail with particular signs of degeneration in the gonad and accessory genital organs. Photomicrographs of these histological pictures are provided. Unfortunately the normal tissues illustrated for comparison are from yet another species of snail, *Biomphalaria pfeifferi*. The authors state that they were unable to find any reference in the literature to this aspect of the action of molluscicides on snails: they must therefore have overlooked the work of WEINBACH and his colleagues on pentachlorophenol [this *Bulletin*, 1956, v. 53, 1251].

C. A. Wright

BERG, E. **Effects of Castration and Testosterone in Male Mice on** *Schistosoma mansoni*. *Trans. Roy. Soc. Trop. Med. & Hyg.* 1957, July, v. 51, No. 4, 353–8. [17 refs.]

The author is interested in host-parasite relationships with particular reference to hormonal affinities and similarities in enzymatic and metabolic cycles. The present study relates to the effects of sexual hormones upon the development of *Schistosoma mansoni* in experimentally infected male mice.

105 male mice were divided into 6 groups. In 3 groups the mice were castrated surgically. Before infection, one group of castrates and one normal group received one subcutaneous dose of 2·5 mgm. of testosterone and 2 similar groups received control injections of saline. All groups were then exposed to infection with *S. mansoni*. In those mice receiving testosterone the injections were continued as bi-weekly doses of 1·25 mgm. of the hormone. The mice were autopsied 57–67 days after infection and the schistosomes recovered by perfusion of the liver and teasing from the mesenteric veins when they were differentiated by sex and counted.

In castrated mice not receiving testosterone and in the castrated-saline group the proportion of male schistosomes that developed was significantly lower than in the uncastrated controls. In the castrated-testosterone group the development of both sexes was reduced but the proportion of females was much lower than that in the uncastrated controls. In the uncastrated-saline controls the proportional development was similar to that of the uncastrated controls. In the uncastrated-testosterone group the mean development of both sexes was lower than that in the uncastrated controls but the proportion of female worms was

lower. The development of females was more adversely affected in the castrated-testosterone group than in the uncastrated-testosterone group.

It is concluded that castration of the mice affected the development of the male schistosomes only and that this may indicate a relationship between the male trematodes and the inability of the male mouse to produce secondary sexual characteristics. It is also concluded that after testosterone therapy the development of female schistosomes was greatly affected in castrated mice; that male parasites were much more inhibited in development by castration than by administration of hormone; that the greatest difference in development was between parasites in the uncastrated control and in those in the castrated mice on testosterone therapy, and that the greater survival rate of female worms in uncastrated mice than in castrated mice suggests that the detrimental action of testosterone is more enhanced when not accompanied by intrinsic male hormones. *O. D. Standen*

MAEGRAITH, B. **Schistosomiasis in China.** *Lancet.* 1958, Jan. 25, 208–14, 5 figs.

This paper gives a concise account of schistosomiasis in China, its symptomatology, diagnosis, treatment and prevention. Schistosomiasis is probably the most serious parasitic disease there; more than 11 million persons are infected and the economic effects are considerable. A nationwide campaign has been organized by the Ministry of Health which it is hoped will control the disease in 12 years. Under a central lay committee trained staff work in 12 regions, and under these are subsidiary units until finally the village communities provide teams from among themselves for the actual field work. Various forms of propaganda are undertaken, and the activities of allied departments are integrated in the campaign.

The clinical effects of schistosomiasis are described. The liver lesions are believed to result from oviposition rather than from the presence of adult worms. Therapy is still unsatisfactory; the sodium and potassium salts of antimony tartrate given parenterally are best but are toxic. Dosage schedules and their relapse rates are tabulated, the most satisfactory being an intensive course over 7 days totalling 15 mgm./kgm. body weight which has a relapse rate of only 15%. In mass diagnosis the people are first screened by an intradermal test in which an extract of the livers of infected rabbits is used as antigen. Stool examinations require to be repeated up to 10 times before a negative result is accepted.

For the prevention of the disease emphasis is laid on the control of promiscuous defaecation and on the storage of faeces for up to a week before use as an agricultural fertilizer. Official payment is made for the night-soil, the family night-soil pot being emptied daily into a communal tank which is sealed when full and after a period of detention is transported to the fields for use. Washing of the pots and tanks is supervised.

Methods of rendering safe the faeces of infected animals, particularly the water buffalo, are still being studied.

The results of studies on the bionomics of *Oncomelania* snails are described. Infected snails have been found to discharge cercariae for over 2½ years. Dew-drops have been found to contain large numbers of cercariae. Tung oil mixtures applied to exposed skin surfaces have been protective in the case of mice and are being tried in the field. Copper sulphate at 50 parts per million is an effective molluscicide, but is expensive and rapidly adsorbed. Paris green (9 gm. per square metre) and calcium arsenate (6 to 12 gm. per square metre) are most commonly used but are harmful to animals and to rice crops. Synthetic molluscicides and indigenous herbs have been found unsatisfactory.

Snails on the banks of streams are controlled by molluscicides and by flame throwers during summer. In winter time mud containing the snails is removed from canals and ditches and is buried, or the old ditches are filled in and new ones made, or the superficial soil is removed from the banks and stored or buried. Flooded land is reclaimed by embankments and the grass kept cut. The substitution of other crops for rice has proved valuable in some cases.

[This is an informative account of schistosomiasis due to *Schistosoma japonicum*, which includes some interesting information on control measures; it should be read in full.] *T. H. Davey*

WAGNER, E. D. & CHI, Lois W. **Egg-Laying Inhibition in** *Oncomelania nosophora* **maintained on Filter Paper.** *Amer. J. Trop. Med. & Hyg.* 1957, Sept., v. 6, No. 5, 946–8.

Previous experiments to determine the type of substrate and influence of water levels on egg deposition of *Oncomelania nosophora* [this *Bulletin*, 1956, v. 53, 1447, 1448] demonstrated that these snails were particularly fond of filter paper. The present report deals with experiments to determine whether snails would survive if fed on filter paper alone and whether these snails would lay eggs with diet and environment so restricted.

25 adult *O. nosophora* were placed in each of 3 Petri dishes containing filter paper moistened with tap-water, spring water or distilled water, respectively. After 4 months the 71 survivors were removed to clay saucers containing filter paper kept moist with spring water. 8 months later, 19 females of the surviving 37 snails were isolated in individual standard culture dishes containing soil and other materials. No eggs or young snails were found during the first 12 months of the experiment when the snails were kept on filter paper alone. Young snails first appeared 40 days after the 19 females had been transferred to dishes containing soil. The longest period between transfer and appearance of young snails was 111 days, and of the 17 females that survived the test,

2 did not produce young. The survival rate of the adults and the number of young produced was lower than that for snails kept in standard cultures the whole time. The reasons for discontinuation of egg laying when on filter paper are not known but it appears reasonable to suppose that the absence of soil which is used for making egg capsules, coupled with a diet that was not as adequate as that in soil cultures, were both factors limiting reproductive capacity. This view is supported by the fact that when snails maintained on filter paper were transferred to soil cultures then reproduction reverted to the pattern normal for the species.

O. D. Standen

CHI, LOIS W. & WAGNER, E. D. **Studies on Reproduction and Growth of** *Oncomelania quadrasi*, *O. nosophora*, **and** *O. formosana*, **Snail Hosts of** *Schistosoma japonicum*. *Amer. J. Trop. Med. & Hyg.* 1957, Sept., v. 6, No. 5, 949–59, 2 figs. [14 refs.]

Comparative observations were made on egg-laying, egg size, incubation period, growth rate of young snails and reproductive capacity of *Oncomelania quadrasi*, *O. nosophora* and *O. formosana*. Egg laying observations on *O. quadrasi* were carried out with the snails kept in clay saucers [this *Bulletin*, 1956, v. 53, 1447]. Eggs from some cultures were left *in situ*, others were transferred to watch glasses. The other species were maintained in Petri dishes. Newly hatched snails were measured weekly. 17 pairs of *O. quadrasi* and *O. nosophora* and 7 pairs of *O. formosana*, all raised from isolated eggs, were mated in separate 7 ml. *p*H beakers containing a little water. After mating, the snails were isolated. The snails were kept at 26°C. and under continuous light for the duration of the experiments.

O. quadrasi and *O. nosophora* laid an average of 0·7 eggs per day over a period of 11 months. Egg-laying occurred daily or with lapses up to 55 days, with the maximum number of eggs per day as 23 or 24 respectively. *O. formosana*, observed over 8 months, laid an average of 1·3 eggs per day with a maximum 19 eggs per day and frequency of egg laying 1–12 days. Average incubation periods for *O. quadrasi*, *O. nosophora* and *O. formosana* were 18·4, 21·4 and 19·5 days respectively; average egg sizes with capsule were 0·6, 1·1 and 1·0 mm. respectively. Growth rates for the same species were 0·2, 0·4 and 0·3 mm. with both sexes growing at an equal rate for 11 weeks when sexual size dimorphism occurred, with the growth of the females exceeding that of the males. Female snails mated only once, produced young snails for average observation periods of 285, 180 and 135 days for *O. quadrasi*, *O. nosophora* and *O. formosana* respectively. The maximum periods of reproduction following a single mating were 385, 213 and 200 days for the species in the same order. Thus, snails were found to produce several hundred young from the one mating. *O. D. Standen*

Hsü, H. F. & Hsü, S. Y. L. **On the Strain Characteristics of *Schistosoma japonicum* from Two Isolated Endemic Areas in Japan.** [Research Notes.] *J. Parasitology.* 1957, Dec., v. 43, No. 6, 610.

There are at least 4 geographic strains of *Schistosoma japonicum*, the Chinese, Formosan, Japanese and Philippine. The authors, in work under publication, have shown that the differences in the prepatent period in a given definitive host and the size and shape of the eggs are good criteria for distinguishing strains. These 2 criteria have been used to determine whether strains of the parasite exist in the widely separate Kyushu and Yamanashi foci in Japan.

30 albino mice were infected by the cutaneous route with 60 cercariae of equally divided sexes, from *Oncomelania nosophora* from each of these 2 endemic areas. From the 30th day the stools of each mouse were examined, and the eggs (50 from each mouse) measured on the 4th day after mature eggs were found. The width/length × 100 was used as an index of egg size. The prepatent period was defined as the period from the day of infection to the day previous to the finding of the first mature egg.

Figures are given for the respective prepatent periods and the variations of the lengths, widths and indices of the eggs between the 2 samples and within the samples. Statistical analysis showed that none of the differences were significant. It was concluded that "*S. japonicum* from Kyushu and Yamanashi, 2 well separated endemic areas in Japan, has no significant differences in the prepatent period and the size and shape of the eggs in albino mice". *H. J. O'D. Burke-Gaffney*

Chang, Yuan-Ch'ang, Chu, Chen-Ch'ing & Fan, Wei-K'o. **Cerebral Schistosomiasis. An Observation of Forty-Five Cases.** *Chinese Med. J.* Peking. 1957, Nov., v. 75, No. 11, 892–907, 15 figs. (10 on 2 pls.) [19 refs.]

Though cerebral involvement in *Schistosoma japonicum* infection is not uncommon, only 10 such cases have hitherto actually been recorded in China. The authors have seen 45 between 1951 and 1955; 8 of them were proven by histopathological studies and one at necropsy. These 45 were encountered among 1,049 cases of schistosomiasis seen in hospital during the period; the incidence of the condition in this series was therefore 4·3%; 43 of the patients were men, and 2 women; most were between 17 and 35 years of age. Cerebral schistosomal lesions, it has been suggested, are due either to the local presence of worms or eggs, or to toxins derived from the parasites. So far no adult worms have been recovered from the human brain; in all 9 of this series where pathological examinations were done eggs were found in the brain tissue. Meningeal thickening and adhesions, exudates along the cortical vessels, schistosomal tubercles on the cortex, granulomata containing ova in the

meninges, and cerebral oedema were the chief findings when the skulls were opened. The symptoms were those of a brain tumour though the size of the granulomata was insufficient to account for their severity. Oedema was the main factor in the production of symptoms; it was due to the reaction provoked by the ova; it is therefore a reversible process, and the stoppage of the deposition of ova by specific treatment will be followed by subsidence of the symptoms. The stage of development of the ova influences the reaction they provoke; mature miracidium-containing ova cause coagulation necrosis, with eosinophil infiltration and abscess formation; immature or calcified eggs cause pseudotubercle formation. There is fibrous tissue proliferation and gliosis around the older foci and degenerative changes, particularly of the astrocytes, in the surrounding brain tissue.

How eggs reach the brain is not clear, but there are 5 theoretical routes: adult worms may grow from cercariae in the cerebral veins or sinuses; a patent foramen ovale affords a direct passage from the inferior caval veins into the systemic circulation; eggs may be embolically borne; worms may travel against the venous stream to the brain; or they may travel from the portal system through Batson's vertebral venous system. Lesions found in the parieto-occipital lobe and in the deep layers of the cortex are consistent with embolism; cerebellar involvement, which is rare, is consistent with invasion through Batson's system.

Clinically, manifestations of cerebral schistosomiasis develop after weeks or years of the infection. The acute cases have an incubation of 6 weeks and simulate encephalitis; symptoms diminish in 3 or 4 months with subsidence of the fever. The chronic appear after 3 or 4 months and take the form of epileptiform seizures due to a brain tumour. The cerebrospinal fluid shows no specific changes except an increase in pressure, a raised protein content, and pleocytosis in the case of space-occupying granulomata. Eggs were found in the fluid in one case. Cerebral manifestations make their appearance after the usual fever, urticaria, diarrhoea and splenic and hepatic enlargements have become evident; but most of the 45 patients under review attended hospital on account of their neurological troubles and were ignorant of the existence of their schistosomiasis. None had cirrhosis or ascites. Stool hatching tests were positive in all but 4 patients. The diagnosis in all cases must initially be made on a history of exposure to infection and the recovery of ova from the stools; this latter is not easy as ova may be scanty or absent even when neurological changes become manifest. Conclusive diagnosis depends on cerebral biopsy together with the clinical findings, which usually include eosinophilia. A crushed tissue biopsy for ova is the most rapid and convenient method during surgical exploration of the brain.

Potassium antimony tartrate treatment should be given promptly on diagnosis, and it benefits the neurological condition. Where there is papilloedema, operation before this is desirable. Hypertonic fluids may

relieve intracranial tension. The prognosis in cerebral schistosomiasis in general is good, no disabling neurological sequelae following prompt and thorough suitable treatment. Some details of illustrative cases, with pneumoencephalograms, and photographs and photomicrographs of brain tissue are appended. *A. R. D. Adams*

WYKOFF, D. E. & LEPES, T. J. **Studies on** *Clonorchis sinensis*. **I. Observation on the Route of Migration in the Definitive Host.** *Amer. J. Trop. Med. & Hyg.* 1957, Nov., v. 6, No. 6, 1061–5.

The traditional view that the developing *Clonorchis sinensis* migrates directly up the biliary passages was questioned, since the parasite stimulates a greater response as estimated by the complement-fixation test than might be expected if it lived exclusively in the biliary passages. (*Fasciola hepatica* was considered originally to migrate directly, but it was shown later to reach the peritoneal surface of the liver after penetration of the gut wall.)

In rabbits with a ligatured or divided common bile duct, excysted metacercariae make their way to the liver and develop. Excysted metacercariae also develop in the biliary passages after injection into the mesenteric vein, though less readily; but not after injection into the peritoneal cavity. [The number of animals in these last two experiments is small, and the authors point out that a period of development in the duodenum may be necessary before penetration can be accomplished.]

"These observations do not rule out the possibility of migration directly from the duodenum into the common bile duct, but are suggestive of a route in which intestinal penetration and transfer to the liver by the portal system is a normal process." *W. E. Kershaw*

GIRCHFELD, R. V., ZAKINE, M. M. & LAKHOVETSKAYA, D. D. [Affection de paragonimose combinée avec la tuberculose des poumons.] [**Paragonimiasis associated with Pulmonary Tuberculosis**] *Problemy Tuberkuloza.* 1957, v. 35, No. 8, 113–16, 4 figs. on 2 pls. [In Russian.] French summary.

Report of a case.

CAPONE BRAGA, P. Considerazioni sulla diffusione dell'echinococcosi in Italia. [**Considerations on the Diffusion of Echinococcosis in Italy**] *Rendiconti Istituto Superiore di Sanità.* Rome. 1957, v. 20, Pt. 11, 1050–68. [16 refs.]

The English summary appended to the paper is as follows:—

"From the human cases reported in Italy by various authors, there would appear to be an appreciable increase in echinococcosis over the last few years.

"In actual fact, this supposed increase does not appear to be confirmed either by the data concerning the patients in public and private clinics, available for the last four years, or from the official figure of deaths during the last fifteen years.

"The author expresses the need for a complete statistical report of the cases of echinococcosis for the purpose of documenting in a clear way the actual extent of the diffusion of the illness in Italy and in this respect he proposes that cases of it should be compulsorily notified."

SUIC, M. L'échinococcose en Yougoslavie. [**Echinococcal Infection in Yugoslavia**] *Bull. World Health Organization.* Geneva. 1957, v. 17, No. 3, 492–6, 2 figs.

In some areas of Yugoslavia 16% of the very large number of dogs are infected with *Echinococcus granulosus*. The viscera of infected animals are fed to dogs because of ignorance, or as a result of incomplete destruction in abattoirs. Some 5 million domestic animals harbour hydatid cysts.

The incidence in man is difficult to assess since the hospitals are in areas where the infection is probably least common. In autopsies the overall incidence in the country is 1 in 304 examinations. The mean number of cases diagnosed each year in hospital was as follows: in the years 1930–47, 141; 1948–51, 471; and 1952–55, 571. The sudden rise after the war may be due to better facilities for diagnosis.

Dalmatia is most heavily affected, for 27·1 cases were diagnosed in hospital per 100,000 of the general population, while the mean for the whole country is 3·37 cases. Greece has a corresponding incidence of 7·37 (1945–49), Bulgaria, 2·88 (1940–50), and Italy, 1·4 (1948–52). In Dalmatia the numbers of patients diagnosed as suffering from echinococcosis are exceeded only by those with tuberculosis and typhus.

Clinical symptoms occur usually between 20 and 30 years of age, and in women about as frequently as in men. 37% of cases are diagnosed in the lungs, possibly because of the increasing use of chest radiography. The mortality is 3%, and of the survivors 56% are completely cured by treatment, 21% are better, 19% are not cured.

The industrialization of Yugoslavia is probably affecting the apparent incidence and distribution, for while hydatid was diagnosed originally mostly in farmers and housewives, the incidence has now risen in industrial workers possibly because of regular medical examinations.

Surveys by Casoni skin tests have given 123 positive cases in 1,321 subjects.

Large economic losses are caused by the infection: 2 million kgm. of food are condemned each year, and it is estimated that a further 12½ kgm. are lost by poor animal condition. A total deficit of 110,000 kgm. of wool is suggested; a loss of 150 litres of milk per annum is suggested for a cow, 15 litres for a goat, and 10 litres for a sheep, making a total loss of 116 million litres of milk in the whole country. In all, animal

losses may amount to 23 m. dollars, and the cost of lost working days and medical treatment to man, 200,000 dollars. [No scientific evidence is given for most of these conjectures.]

Prevention is based on health education and propaganda through public health workers, teachers, films and gramophone records, though such measures are difficult to implement in Yugoslavia. *W. E. Kershaw*

DISSANAIKE, A. S. **Some Preliminary Observations on** *Echinococcus* **Infection in Local Cattle and Dogs.** *Ceylon Med. J.* (n.s.) 1957, Nov., v. 4, No. 2, 69–75, 6 figs.

In Ceylon, all the cases of human hydatid disease have been described in foreigners, and none in the indigenous population; in the sheep and goats imported from South India infection is known to be common. A preliminary survey of *Echinococcus* infection was done for one month in the local animals in the Colombo slaughterhouse, those animals imported in the north of Ceylon, and on the dogs and workers in the dog pounds in the Colombo anti-rabies clinic.

Of some 9,000 indigenous cattle slaughtered, a sample of 4,000 contained 22 animals with infection (0·5%), with a total of 34 cysts, and a lung/liver ratio of 19/5.

In 460 imported sheep and goats, 2·4% were infected. No data are available on the local sheep and goats, though they are less frequently infected than the cattle.

In 27 dogs, one contained one gravid segment of *E. granulosus* and 2 adult *Taenia hydatigena* (the larval stage being common in imported sheep and goats). 2 of the 7 workers in the dog pound had positive Casoni reactions, and in them no cysts were discovered by clinical or radiological examination.

Condemned organs are disposed of by immersion in disinfectant, after which they are taken to a municipal destructor; they may, however, be accessible to the dogs of slaughterhouse labourers. Hydatid disease may occur in a few indigenous persons, particularly near Anuradhapura: dogs and jackals may be the reservoirs of infection. [The possible occurrence of *E. multilocularis* in the wild animals should be considered.]

W. E. Kershaw

POGGI, I. & BONETTI, F. L'infestazione da *Ancylostoma duodenale* nel Comune di Brescia. Considerazioni epidemiologiche dedotte da 15 anni di osservazione. [**Ankylostomiasis in Brescia**] *Giorn. di Malattie Infettive e Parassit.* 1957, Dec., v. 9, No. 12, 1078–84. [19 refs.]

This report relates to observation of the epidemiology of *Ancylostoma duodenale* in the city of Brescia for 15 years from 1940 to 1955. After having mentioned the cosmopolitan nature of the disease the authors state that its notification first became compulsory for brick-workers,

miners and other underground workers in 1925, and was then extended to all suspected or proved cases in 1933. In the city the fact that the distribution of the cases was almost entirely among market-gardeners and their families induced the senior author, who is the City Medical Officer, to carry out an epidemiological investigation in 1940. Another similar investigation was made in 1955–56.

In the first enquiry samples of faeces from persons who had been admitted to hospital in preceding years for ankylostomiasis were obtained, then the investigation was widened to their families and finally to all engaged in market-gardening in the city. Those found positive were treated with tetrachlorethylene, in doses varying from 2 capsules of 0·6 gm. for children 2–5 years old to 6 capsules for adults, or else 10% chloroform in castor oil, dosage being 20 gm. for 2–5-year-old children and up to 40 gm. for patients over 14. Those with definite clinical symptoms were admitted to hospital, the rest being treated as out-patients.

The results were as follows. In the 1940 enquiry 1,096 persons were examined, of whom 224 were found to be positive; only 1 was not a market-gardener. The ages most affected were 16–20, but 9% of children under 5 were infected. In the 1955–56 enquiry 750 specimens were examined, 290 of which were from patients who had been positive in 1940. 68 were positive including 28 of the 290 previously examined. The treatment by chloroform was found to be the more satisfactory in 1940, and much more so in 1955–56. Topographically, in 1940, 8 out of the 17 " wards " of the city showed cases, 1 area especially; in the 1955 investigation 3 " wards " were infected, the most serious being the same as in 1940. More males were found infected in 1955 than in 1940. The most seriously infected area was semi-rural; horticulture was intensive, the ground was clayey and fertilized with sewage, and the economic and hygienic conditions of the inhabitants were very poor.

The authors consider that the persistence of the infection is due to the soil conditions as well as to the condition of the inhabitants; that since 1940 the disease has become much more an occupational one; and that only in rare cases is there a patent disease. They recommend, in addition to treatment of the patients, the use of calcium cyanamide for fertilizer, and extensive health education. *W. K. Dunscombe*

ONABAMIRO, S. D. **Intestinal Poly-Parasitism among Nigerian School Children.** *West African J. Biol. Chem.* London. 1957, Oct.–Dec., v. 1, No. 3, 71–87, 13 figs. [12 refs.]

This paper gives details of infection with *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Trichuris trichiura* in 380 Nigerian schoolchildren between the ages of 6 and 15. 30 lived in modern homes with water sanitation, etc. The rest were divided between semi-modern homes with bucket latrines and villages with no sanitation.

Ascaris infection was not dependent on age and was higher after than before the rainy season. *Ancylostoma* and *Trichuris* infection increased with age but did not alter significantly during the rainy season. Children in rural villages carried heavier loads of worms than those in modern houses. Mixed infections were common: 49·28% boys (though only 9·09% girls) between 13 and 15 had all three worms.

Quantitative examination of stools for helminth ova was done by the method of STOLL and HAUSHEER [this *Bulletin*, 1926, v. 23, 776]. The highest counts of *Ancylostoma* ova were 21,700 and 19,300 per gm. of faeces. The boys in whom these were found were stunted and mentally backward. The average haemoglobin index in the most heavily infected group was 78·2%. Eosinophil cell counts and ova counts did not correlate. Several tables and figures give details of the results of stool examinations. Haemoglobin indices and weights of pupils are not tabulated. *B. B. Waddy*

PATERSON, D. E. *Strongyloides* **Infestation of the Jejunum.** *Brit. J. Radiol.* 1958, Feb., v. 31, No. 362, 102–3, 3 figs. [13 refs.]

Report of a case in South India.

BIRD, A. F. & DEUTSCH, K. **The Structure of the Cuticle of** *Ascaris lumbricoides* **var.** *suis*. *Parasitology*. 1957, Dec., v. 47, Nos. 3/4, 319–28, 22 figs. on 3 pls. [19 refs.]

BEAVER, P. C. **Human Disease from Common Worms of Dogs and Cats.** *South African Med. J.* 1958, Jan. 11, v. 32, No. 2, 42–5. [18 refs.]

Cutaneous larva migrans, Loeffler's syndrome and visceral larva migrans, are acquired by direct contact with cats and dogs. In cutaneous larva migrans the infective larvae of the animal hookworms, usually *Ancylostoma braziliense*, either die after wandering in the subcutaneous tissue, or go deeper. Loeffler's syndrome is due to a transient pulmonary infiltration, cough and eosinophilia and may follow cutaneous larva migrans. Developing larvae can be recovered from the sputum, often in large numbers [this *Bulletin*, 1953, v. 50, 827], and immature or mature adults of the animal worm recovered from the gut of man.

In visceral larva migrans, the wandering larvae (*Toxocara canis* and *T. mystax*, and probably *Capillaria hepatica*, *Gnathostoma* spp., and *Dirofilaria* spp.) probably remain alive in the tissues. *Toxocara canis* is a parasite of young dogs, and may occur as a transplacental infection. The life cycle is similar to that of *Ascaris lumbricoides*, and the eggs of both worms are often ingested by toddlers together with those of *Trichuris trichiura*. Multiple tracks of necrosis are produced in the wake of the

migrating larvae in the liver and in most other organs including the brain and the eyes. The liver is enlarged and the eosinophil count is raised. The suspicion of eosinophilic leukaemia or retinoblastoma may lead to laparotomy. Serological tests help little in diagnosis, and both the demonstration and identification of the larvae are very difficult technically, since those of *Toxocara*, *Ascaris*, *Necator*, *Ancylostoma* and *Strongyloides* must be differentiated. The syndrome is caused only by those larvae undergoing little or no growth in man, and the visceral infections last long and may confuse the clinical manifestations of other intercurrent infections. No specific treatment is known, and precise diagnosis awaits better methods. Prevention of the infection is rendered difficult by the tolerance of habits in domestic pets which would be resented in the case of man. *W. E. Kershaw*

SCHACHER, J. F. **A Contribution to the Life History and Larval Morphology of** *Toxocara canis*. *J. Parasitology*. 1957, Dec., v. 43, No. 6, 599–612, 23 figs/on 2 pls. [25 refs.]

BASU, P. C. **Filariasis in Assam State.** *Indian J. Malariology*. 1957, Sept., v. 11, No. 3, 293–308, 2 maps.

This paper reports the results of filariasis surveys of two tea-garden areas in the State, *viz.*—Bokakhat and Chabua. In Bokakhat area 2,213 persons were examined representing 15% of the population. The microfilarial infection rate was 4·5%, 74% of the infections being *Wuchereria malayi* and 26% *W. bancrofti*. Both infections were nocturnally periodic. The disease rate was 3·3%; 58% of the diseased were males and 42% females. In Chabua area, 1,739 persons were examined, *i.e.*, 13% of the population. The infection rate was 7·9% with 81·3% of the infections due to *W. bancrofti* and 18·7% to *W. malayi*. Disease was present in 1·8% but did not affect those under 20 years of age. Both sexes were equally affected.

In Bokakhat antimalarial spraying with residual insecticide had been started 2 years before. Mosquitoes were collected there in the morning and evening in houses and cattle sheds, and of 2,314 female specimens, belonging to 12 species, 1,944 were *Culex fatigans* and 202 *Mansonioides uniformis*. On dissection 4 infected *C. fatigans* were noted; this species occurred mainly in human habitations. None of the *M. uniformis* or other species proved infected, the first being mainly taken in cattle sheds. Chabua had not been sprayed until BHC was used during the survey. Here 7 species were taken in catches made mostly in the mornings, including 1,728 female *C. fatigans* and 1 *M. uniformis*. Comparison of *C. fatigans* density before and after the commencement of spraying showed that neither density nor longevity was affected.

It was noted that filarial endemicity was highest in immigrant labour

(21·4%) and lowest in the indigenous people (4%). It is surmised that the infection was imported, and it is recommended that other tea-growing areas in Assam should be surveyed and control measures instituted in infected areas to protect the one million persons at risk in the Assam plains. *T. H. Davey*

TJERNBERG, B. **Lymphography as an Aid to Examination of Lymph Nodes. (Preliminary Report.)** *Acta Soc. Med. Upsaliensis.* 1956, Nov. 30, v. 61, Nos. 3/4, 207–14, 16 figs. on 12 pls. [14 refs.]

"1. The suitability for lymphography of various types of contrast media, and the different methods of introducing them into the lymphatic system are examined. Of the contrast media that could be submitted to clinical trial 'Biligrafin' (Schering) proved to give the best results. The most reliable method was to inject the substance directly into a lymphatic channel through a polyethylene catheter (the intralymph-vascular route). The simpler method of injecting the contrast medium into the lymph nodes (the intranodular route) gave satisfactory results in many cases.

"2. The value of lymphography in lymphadenitis and in malignant lymphadenopathy is assessed in rabbits. For the first time it has been possible *by radiological methods to demonstrate and distinguish between inflammatory reactions and neoplastic growths of the lymph nodes.*"

[See this *Bulletin*, 1956, v. 53, 1158, for relevance to tropical elephantiasis.]

DUKE, B. O. L. **A Case of 'Streptocerciasis' in a European.** *Ann. Trop. Med. & Parasit.* 1957, Dec., v. 51, No. 4, 364–7.

So far, infections of man with *Acanthocheilonema* [*Dipetalonema*] *streptocerca* have been considered to be asymptomatic. The present case appears to demonstrate that this view has been erroneous. The patient was an Englishman, aged 32, who had been stationed at Kumba in the British Cameroons for two years. For almost the whole of this period he had complained of an itching eruption on the skin of the left forearm. After a period of one year it spread to the upper arm and over the left, and to a lesser extent to the right, scapula region. Minute, irritating blisters used to form and dermatologists had treated the complaint as "skin sensitivity". Reddish-brown papules, 2–4 mm. in diameter, some of which developed a central pin-point vesicle, were seen. No nodules were found. The eosinophilia of the blood was 16%. Skin snips from the left forearm, deltoid and scapula regions yielded microfilariae of *A. streptocerca.*

Treatment with tablets of Banocide [diethylcarbamazine] containing 50 mgm. of the citrate salt was continued for 25 days. On the fifth day

of treatment (after 18 tablets) a very considerable cutaneous reaction, probably allergy, developed. On the 11th day, when a total of 72 tablets (3·6 gm.) had been taken, treatment was stopped. After 4 days' cessation of Banocide the acute dermatitis subsided: after 5 weeks itching ceased. 2 months after taking the first abbreviated course, the patient continued treatment, with the result that a second, but less intense, reaction took place after 5 days. The patient continued the treatment without further incident till all symptoms had subsided and it was considered that the skin was clear of microfilariae. A total of 159 Banocide tablets were taken, or 7·9 gm. of the citrate salt.

Philip Manson-Bahr

Rodger, F. C. & Brown, J. A. C. **Assessment of the Density of Infection with Onchocerciasis and the Probable Level of Safety from its Ocular Complications.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1957, May, v. 51, No. 3, 271–82, 2 figs.

The authors' summary is as follows:—

"(1) A method of assessing the density of infection with onchocerciasis in an individual, called the Individual Density Figure, is given, and the factors considered in devising the method discussed in detail.

"(2) The method is based on the known anatomical distribution of the mf. population, and not on mf. counts, which are shown to be subject to wide variations in the same site in untreated cases from day to day.

"(3) A method of assessing the density of infection with onchocerciasis in a community, called the Density Quotient, and based on the same principle, is also given, and discussed in detail.

"(4) In the individual, conjunctival biopsies and skin biopsies from the neck, chest, thigh and calf are taken; in subjects in a random sample within a community, conjunctival biopsies and skin biopsies from the neck and calf only. A system of scoring is explained for each.

"(5) The number of people blinded by onchocerciasis and the average number of onchocercomas per person are factors discarded in assessing the degree of infection.

"(6) It is suggested that a safe level of infection exists, at which there is no risk of blindness; this level is measurable by the methods recommended. It is this level at which all therapeutic and control measures should aim."

[This paper does not lend itself readily to abstraction, since it represents a complex attempt to treat qualitative data in a quantitative manner, with arbitrary conventions and standards. Since the assessment of the intensity of infection in the individual and in the community can be made so easily and with biological accuracy by direct quantitative means, such complexity seems to the abstracter to be unnecessary, and indeed possibly misleading.]

W. E. Kershaw

INATOMI, S. **A Study on the Structure of Egg Shell of *Enterobius vermicularis* (Linnaeus, 1758) Leach, 1853, with the Electron Microscope.** *Acta Med. Okayama.* 1957, Apr., v. 11, No. 1, 18–22, 7 figs.

"1. The shell of the ova of *Enterobius vermicularis* is composed of two chitinous layers, a compact outer layer and a loose inner layer. Both surfaces of the two layers have a dense border.

"2. The outer layer has innumerable tubules about 0·2 micron in diameter, and only those tubules found in the thinner part of the layer open to the outside and inside.

"3. The outer layer of mature eggs is about 0·45 micron and the inner layer about 2 to 6 microns, in thickness.

"4. The chitinous microfibrils in both layers form a reticular structure which contains very fine granules in the mesh."

CHIPMAN, Paula B. **The Antigenic Role of the Excretions and Secretions of Adult *Trichinella spiralis* in the Production of Immunity in Mice.** *J. Parasitology.* 1957, Dec., v. 43, No. 6, 593–8.

"Antigenic material associated with the excretions and secretions of adult *Trichinella spiralis* was collected by incubating the worms in a nutrient fluid for 2 days. When used unaltered and given in small daily injections, it produced an immunity in mice as revealed after certain infections by the presence of significantly smaller worm burdens (adults and larvae) than those in controls. Twelve injections were required to demonstrate a reduction in the number of adult worms, whereas a reduction in the number of larvae was noted after both 6 and 12 injections. The results show that the adult phase of *T. spiralis*, as well as the pre-adult phase reported earlier, contributes to the total immunity produced by the host."

[See this *Bulletin*, 1956, v. 53, 644.]

DEFICIENCY DISEASES

BARON, J. H. & OLIVER, L. C. **Fulminating Beriberi.** *Lancet.* 1958, Feb. 15, 354–6. [26 refs.]

"Fulminating beriberi developed in a woman resident in Great Britain.

"The disorder manifested itself as peripheral neuropathy and later (while the patient was in hospital) as acute Wernicke's encephalopathy, Korsakov psychosis, cardiac failure, and oedema. The patient was later found to have advanced gastric atrophy.

"The disorder responded partially to vitamin therapy."

MORRIS, G. C. R. **Fulminating Beriberi.** [Correspondence.] *Lancet.* 1958, Mar. 1, 477.

Report of another case in Britain.

WATERLOW, J. C. & MENDES, C. B. **Composition of Muscle in Malnourished Human Infants.** [Correspondence.] *Nature.* 1957, Dec. 14, v. 180, 1361–2.

When the first author and WEISZ [this *Bulletin*, 1957, v. 54, 77] investigated the livers of malnourished infants they related the protein content to deoxynucleic acid and thereby obtained an index of the amount of protein per cell. A very severe loss of protein was demonstrated. In the present investigation this technique has been extended to the examination of muscle. 7–10 days after 18 malnourished infants had been admitted to hospital specimens weighing 50–100 mgm. were taken under local anaesthesia from the pectoralis major muscle. The procedure was repeated after 1–3 months of treatment. Between the first and second biopsies the ratio of non-collagen-nitrogen/deoxynucleic acid increased by 45%. This would indicate a considerable rise in cellular protein concentration. In addition, as it is probable that new deoxynucleic acid had been formed as well as new protein, these findings indicate that the total muscle mass itself must have increased by more than 45%. *H. Lehmann*

SUCKLING, P. V. **The Erythrocyte Sedimentation Rate in Kwashiorkor in Cape Coloured Children.** *South African J. Lab. & Clin. Med.* 1957, Dec., v. 3, No. 4, 308–15, 2 figs. [16 refs.]

On treatment of kwashiorkor with a milk diet there is a very notable rise in the erythrocyte sedimentation rate (ESR) within the first week. This was observed in 42 survivors among 69 cases of the disease in Cape Coloured children treated at the Groote Schuur Hospital, Cape Town. In 6 selected patients, parallel estimations were made of the ESR, packed cell volume, total plasma protein, and plasma albumin and fibrinogen. 2 of these patients also had tuberculosis, 2 also had otitis media, and 2 had kwashiorkor only. In all 6, changes in the ESR corresponded with changes in the plasma fibrinogen. The cause of the great rise in plasma fibrinogen is not decided, but it is noted that even a short period of treatment with milk may greatly alter the ESR reading, and that this may account for the variable results hitherto recorded. *Alan B. Raper*

SPRUE

KRIKLER, D. M. **The Sprue Syndrome.** *South African Med. J.* 1958, Feb. 1, v. 32, No. 5, 120–26, 4 figs. [57 refs.]

"A biopsy-proven case of idiopathic steatorrhoea (non-tropical sprue) is presented. Advances in the aetiology, pathology, diagnosis and management of the sprue syndrome are outlined. It is certain that better understanding of this complicated group of illnesses will follow the recent demonstration of histological changes in the small intestine. While the causes are not all known, the mechanisms of the malabsorption are becoming better understood, and symptomatic control can be expected in a high proportion of cases. Laparotomy may be needed to establish the diagnosis, particularly where the possibility exists that the steatorrhoea may be due to the anatomical 'stagnation syndrome' and thus be amenable to surgical cure."

BUTTERWORTH, C. E., Jr., SANTINI, R., Jr. & PEREZ-SANTIAGO, E. **The Absorption of Glycine and its Conversion to Serine in Patients with Sprue.** *J. Clin. Investigation.* 1958, Jan., v. 37, No. 1, 20–27, 7 figs. [29 refs.]

"1. Concomitant chemical determinations of plasma glycine, serine, and total amino acid nitrogen after oral glycine administration have been carried out in nine normal subjects, eight persons with sprue in relapse, and nine persons with sprue in remission.

"2. The curves indicate a slow rate of intestinal absorption and a delayed peak value in untreated subjects as compared with normals. Treated subjects were intermediate between the two.

"3. The curves are similar in pattern for each substance in any given category of subjects, suggesting that serine and total amino acid values are directly related to the rate of glycine absorption from the intestine.

"4. There is no evidence of impaired conversion of glycine to serine in patients with sprue in relapse. Such patients display significantly higher concentrations of plasma serine after oral ingestion of glycine than do normal persons, suggesting an impairment of serine utilization."

HAEMATOLOGY

PAREKH, J. G., MODY, B. N., JHALA, H. I., KOTHARI, G., DIXIT, C. H. & RAMASARMA, G. B. **Studies in Serum Iron in Normal.** *J. of J.J. Group Hosps. & Grant Med. College.* Bombay. 1957, Oct., v. 2, No. 4, 317–27. [20 refs.]

The title of this paper is misleading, probably owing to an editorial mistake, for the authors in fact describe the serum iron findings in several

groups of diseases, after referring very briefly to their previous report on 68 normal persons. A table sets out the findings, and from it the following results are abstracted:—

Group	No. of cases	Serum Fe (μgm./100 ml.) Average	Serum Fe (μgm./100 ml.) Range	Average Hb (gm./100 ml.)	Average MCHC (%)
Normals	68	175	83–396	...	...
Professional blood donors	60	94	31–292	10·9	28·7
Piles and menorrhagia	10	54	21–104	4·19	25
Hookworm infection:					
Normoblastic	13	71	42–104	5·7	26·7
" Dimorphic "	4	140	104–208	5·1	27·7
Nutritional anaemia:					
Normoblastic	10	84	42–162	5·31	26·2
" Dimorphic "	5	73	21–135	6·0	29·4
Cirrhosis of liver	6	68	21–125	8·76	28·3
Various diseases	14	...	21–229	...	...

The authors admit that between the various groups there was of necessity much overlapping, since in each group the dietetic history often revealed a general shortage of iron and protein, and diarrhoea was common. Low serum iron was the predominant finding, the occasional very high figures (seen in the table as the upper limit of the range) occurring in cases resistant to treatment. Whether thalassaemia minor accounted for some of these is not mentioned, but it is stated that " One case of sickling thalassaemia had a low value, possibly due to associated nutritional deficiency ". *Alan B. Raper*

Payet, M., Linhard, J., Pene, P. & Armengaud, M. Considérations éthiologiques et hématologiques à propos de 152 cas d'anémies en milieu Africain à Dakar. [**Aetiological and Haematological Observations on 152 Cases of Anaemia in Africans in Dakar**] *Méd. Afrique Noire*. Dakar. 1957, Sept. 16–30, v. 4, No. 18, 355–7.

This is one of many valuable papers coming from the Dakar group of workers in which the aim is to survey the causes of ill health important in Africans. Here a study of 152 cases of anaemia in Dakar has been made, and of this total 94 were the subjects of extensive haematological investigations and 38 of further specialized investigations of the cause of the anaemia. The principal aetiological factors were found to be ankylostomiasis, post-partum haemorrhage, malaria, sickle-cell anaemia, schistosomiasis, hepato-splenomegaly, cirrhosis of the liver, chronic nephritis and anaemias secondary to melaena, epistaxis and non-parasitic haematuria. In approximately 20% of patients two or more causes of

the anaemia could be found. The authors emphasize the importance of the "hepato-splenic" syndrome as a cause of anaemia in Africans in the Dakar region and they also draw attention to the considerable number of cases (approximately 20%) in which no known cause for anaemia could be found. They suggest that nutritional, genetic and sociological factors affect the characteristics of Africans' pathological responses and that though they acquire a dearly won equilibrium with their environment this equilibrium is always precariously balanced.

A. W. Woodruff

PAYET, M. & ARMENGAUD, M. Etude clinique et pathogénique du coeur chez les grands anémiques et dans certains états myocardiques séquelles. (A propos de 38 observations d'anémies tropicales graves, et de 12 cas de myocardies post-anémiques.) [**Pathogenic-Clinical Study of the Heart in Severe Anaemia and in Certain States of Consecutive Myocardia**] *Bull. et Mém. École Préparatoire Méd. Pharm. de Dakar.* 1956. v. 4. 15–44. 21 figs. & 1 chart. [123 refs.]

A special study is here reported of the cardiological state in 38 patients encountered in the Department of Medicine of the Medical School, Dakar, and suffering from severe anaemia. Severe cardiac insufficiency was present on admission in 25 of the patients; the classical symptoms of palpitations and dyspnoea on effort were invariably present but none of the patients suffered from anginal pains.

The anaemia engendering the cardiac disorder was secondary to parasitic disease, hereditary haemoglobinopathy, malnutrition, liver cirrhosis, haemorrhage or pregnancy.

The heart in all these anaemic patients was enlarged with the apex beat displaced to the left. There was an increase in the peripheral venous pressure in 18 out of 20 of the patients in whom the pressure was measured. The circulation time was measured in 14 patients and was diminished in all. The observation was made that whereas transfusion of packed blood cells invariably caused disappearance of the cardiac disability, cardiac insufficiency did not invariably develop in patients with very severe anaemia. All the patients in whom cardiac complications occurred during the course of anaemia were suffering from constitutional damage associated with hepato-splenomegaly and cirrhosis of the liver or parasitic, nutritional or other disease.

The conclusion is reached that in severe anaemia among West Africans the commonest cardiac complication is right ventricular heart failure, in the production of which anoxaemia of the heart muscle plays a large part. If this anoxaemia is not rapidly corrected irreversible cardiac dilatation may occur. Anaemia may thus be the cause of a proportion of the enlarged hearts so commonly encountered in Africans.

A. W. Woodruff

Björkenheim, G. **Neurotropic Factors in the Fish Tapeworm.** *Acta Med. Scandinavica.* 1957, Dec. 28, v. 159, No. 6, 433–7.

"Extract of the fish tapeworm had a marked neurotropic effect in clinical tests in three cases of pernicious anaemia. This seems to suggest that the tapeworm causes neural degeneration in pernicious tapeworm anaemia by absorbing neurotropic factors from the intestinal contents, which are normally utilized by the nervous system of the host. The vitamin B_{12}-like effect of these factors is discussed. It is emphasized that this finding substantiates the view that tapeworm anaemia is a real symptomatic pernicious anaemia, *i.e.* a manifestation of vitamin B_{12} deficiency."

[See this *Bulletin*, 1952, v. 49, 178, 418, 537; 1953, v. 50, 534, 553.]

Havard, C. W. H., Lehmann, H. & Scott, R. B. **Thalassaemia Minor in an Englishwoman.** *Brit. Med. J.* 1958, Feb. 8, 304–5, 1 chart, 1 fig. & 1 pl.

"The case is reported of a middle-aged woman of East Anglian farming stock in whom a refractory hypochromic anaemia was shown to be due to thalassaemia minor. Evidence of this disorder was also found in her two brothers, but not in her sister or her son." The evidence adduced was:—a mild iron-resistant hypochromic microcytic anaemia, with target cells, reticulocytosis (3·4%), an intensely normoblastic marrow, raised osmotic resistance of the red cells, Hb F at levels of 3·1% to 6·1%, Hb A_2 at levels of 5·1% to 8·5%, a normal level of serum Fe, no evidence of syphilis or of liver disease, and with a characteristic pattern of inheritance.

Besides adding another thalassaemia family to the very few reported in natives of Britain, this paper provides a model of the minimum diagnostic criteria now needed for this disease. *Alan B. Raper*

Gerald, P. S. & Diamond, L. K. **The Diagnosis of Thalassemia Trait by Starch Block Electrophoresis of the Hemoglobin.** *Blood.* 1958, Jan., v. 13, No. 1, 61–9, 3 figs. [20 refs.]

Diacono, H. & Castay, Mathilde. Comportement et individualisation antigénique comparés de l'hémoglobine de l'anémie de Cooley et de l'hémoglobine normale du type foetal par la méthode de déviation du complément. [**Behaviour and Antigenic Individuality on Comparison of the Haemoglobin of Cooley's Anaemia and of Normal Foetal Haemoglobin by the Method of Complement-Fixation Test**] *C.R. Soc. Biol.* 1957, v. 151, No. 5, 845–8, 2 figs.

The authors have sensitized guineapigs against human foetal red cells and then added to the guineapig serum various human haemoglobins as antigens. After the interaction a haemolytic system was prepared by the

addition of guineapig anti-sheep serum and a suspension of homologous red cells. When this system was tested after the reaction between the anti-foetal-red-cell serum and foetal haemoglobin, a greater complement fixation was noted than when the same serum had been tested with the alkali-resistant haemoglobin from a case of thalassaemia. The authors therefore conclude that they have shown that the alkali-resistant haemoglobins seen in the thalassaemia and in young infants are not identical. [This is the only work suggesting a difference between the two alkali-resistant haemoglobins. All other publications in recent years coming from different laboratories suggested the conclusion that the two are the same.]

[See also this *Bulletin*, 1957, v. 54, 872.] *H. Lehmann*

MEHROTRA, T. N. & DAYAL, R. S. **Thalassemia (Cooley's Anemia) with Bone Marrow Study. Case Report.** *Indian J. Med. Sci.* 1957, Dec., v. 11, No. 12, 994–8, 3 figs. on pl. [10 refs.]

"Two cases of thalassemia major and two cases of thalassemia minor are reported in a Punjabi Sikh family. The hematological findings were typical.

"The morphological changes in bone marrow are discussed."

CHATTERJEA, J. B., SWARUP, S., GHOSH, S. K. & RAY, R. N. **Hb.S-Thalassaemia Disease in India.** *J. Indian Med. Ass.* 1958, Jan. 1, v. 30, No. 1, 4–8, 4 figs. (2 on pl.) [29 refs.]

"An instance of Hb.S-thalassaemia is described in a ten year old Indian girl. The girl presented haemolytic anaemia of moderate degree. Different findings suggest interaction between genes for thalassaemia and Hb.S."

i. LANGUILLON, J. & DELAŚ, A. Note sur la sicklémie et les groupes sanguins chez diverses populations du Cameroun. [**Sickling and Blood Groups in Different Ethnological Groups in the French Cameroons**] *Méd. Trop.* Marseilles. 1957, Nov.–Dec., v. 17, No. 6, 830–35, 1 map.

ii. ————. Note sur la présence d'hémoglobines anormales chez les Bantous du Sud Cameroun. [**Abnormal Haemoglobin in the Bantu of the Southern French Cameroons**] *Ibid.*, 899–900.

i. Among the 3 million people in the French Cameroons there are some 140 ethnological groups, which may be broadly divided into the Bantu, semi-Bantu and Pygmies in the south and the Foulbé and Kirdi in the north. The authors give brief notes on the main divisions and sub-divisions and indicate their location on a sketch map.

They have examined blood films for evidence of sickling from 1,200 Bantu, 432 semi-Bantu, 350 Pygmies, 300 Foulbé and 1,130 Kirdi. The percentages showing sickling were respectively 18·2, 11·8, 12, 6·33 and 6·9. Attention is called to the cross-breeding which exists, with other ethnological groups, both in the semi-Bantu and the Pygmies. It is noted that RAVISSE found an incidence of sickling of 6·8% in the Babinga pygmies [this *Bulletin*, 1953, v. 50, 645]. The authors also studied the blood groups, and the results are shown in tabular form. No rhesus negative bloods were found.

ii. Paper electrophoresis was carried out on the blood of 225 Bantu from the southern French Cameroons to identify abnormal haemoglobins. There were 23·1% AS, 0·88% SS, and 0·44% AC.

The author points out that the incidence of haemoglobin C diminishes as the distance from Ghana increases. For example, EDINGTON and LEHMANN [*ibid.*, 1954, v. 51, 1188] found an overall frequency of 12% for the C gene, in the [then] Gold Coast, while the figures quoted by the author [no references given] for Nigeria and Sierra Leone, and for the Gambia are 5% and 2% respectively. *H. J. O'D. Burke-Gaffney*

SHUKLA, R. N. & SOLANKI, B. R. **Sickle-Cell Trait in Central India.** *Lancet.* 1958, Feb. 8, 297–8, 1 fig. [12 refs.]

The authors have found a sickle-cell trait incidence of 22% in 450 Mahars. The Mahars are widely spread in Maharashtra, the Marathi-speaking part of Bombay province. They are included in the scheduled castes and for various reasons, including anthropometric measurements, are thought to occupy a position midway between Marathas and Veddoids. A sickle-cell trait incidence of about 10% was also found in two other Marathi-speaking castes, the Kunbi (11 of 116) and the Teli (9 out of 80). These are agriculturists and oil pressers, respectively, and show no connexion with the Indian primitives, but belong to the mesocephalic elements which came to India from the north-west. The presence of the sickling trait in these two castes is of great interest and it is suggested that the gene for sickling might have been introduced by a few persons and its incidence then risen from generation to generation as a result of a slightly higher malarial mortality of the non-sicklers. Altogether 1,010 Marathi-speaking people were examined, but sickling was only found in the three castes of the Mahar, Kunbi and Teli. *H. Lehmann*

BATABYAL, J. N. & WILSON, J. M. G. **Sickle Cell Anaemia in Assam.** *J. Indian Med. Ass.* 1958, Jan. 1, v. 30, No. 1, 8–11, 1 fig. [10 refs.]

"Two cases of sickle cell anaemia are presented and the reasons for arriving at this diagnosis are discussed.

"In Cases 1 and 2 the family history is suggestive of heterozygous parentage for the haemoglobin S gene, and this is borne out by haemoglobin electrophoresis studies.

"In a pilot survey, the incidence of sickling amongst immigrant workers from Orissa in South-East India was found to be 15 per cent.

"The reasons for the comparative rarity of reported cases of sickle cell anaemia in Assam are discussed."

[See this *Bulletin*, 1953, v. 50, 645.]

ROBERTS, A. R. & HILBURG, L. E. **Sickle Cell Disease with** *Salmonella* **Osteomyelitis.** *J. Pediatrics.* St. Louis. 1958, Feb., v. 52, No. 2, 170–75, 4 figs. [29 refs.]

"A more than coincidental association between Salmonella osteomyelitis and sickle cell disease is suggested by our 4 cases and a review of the cases previously reported.

"We postulate that the bone changes caused by sicklemia may result in Salmonella osteomyelitis from previously dormant medullary organisms or from transient bacteremia."

[See this *Bulletin*, 1958, v. 55, 89.]

VEGAS, F., RODRÍGUEZ RIVERA, L., ORTIZ RIVAS, E. & MAZA PÉREZ, C. Estudio sobre las hemoglobinas. Enfermedad de la hemoglobina C en la raza blanca. Reporte del primer caso en Cuba. [**Study of Haemoglobins. Haemoglobin C Disease in the White Race. Report of the First Case in Cuba**] *Archivos Hospital Universitario.* 1957, Sept.–Oct., v. 9, No. 5, 308–23, 9 figs. [47 refs.] English summary (8 lines).

GERUNDO, M., STRANSKY, E. & CAMPOS, P. O., with the assistance of Isabel L. NG. **The Concept of Hemoglobinopathy.** *J. Philippine Med. Ass.* 1957, Oct., v. 33, No. 10, 725–30, 1 fig. [15 refs.]

This is a survey of the haemoglobinopathies, with particular reference to patients seen at the Departments of Medicine and Pediatrics of the University of Philippines Postgraduate Hospital Medical Center. The main outcome is that both haemoglobin E and haemoglobin F were found associated with anaemias of various kinds. It seems that haemoglobin F was seen in a case of multiple myeloma and possibly in 2 cases of chronic myelogenous leukaemia, and one of cholecystitis. [It would be interesting to know whether the last patient was in fact suffering from thalassaemia. In this disorder pigment stones and cholecystitis are not unusual, particularly if there has been much blood transfusion.]

H. Lehmann

STRANSKY, E. & CAMPOS, P. O. **On Hemoglobin E in the Philippines (Hemolytic Anemia, Stransky-Regala Type).** *J. Philippine Med. Ass.* 1957, Oct., v. 33, No. 10, 731–9, 2 figs. [23 refs.]

This article deals mainly with the fact that haemoglobin E has been found not infrequently in the Philippines. A previously described erythroblastic familial anaemia named haemolytic anaemia, Stransky-Regala type [*Amer. J. Dis. Children*, 1942, v. 63, 859; this *Bulletin*, 1947, v. 44, 343] may be in fact either haemoglobin E disease or haemoglobin-E thalassaemia disease. Emphasis is laid on the difference of the severity of the anaemia. In one family some children may be severely affected while others, though carriers of haemoglobin E, may be quite normal. [A wide variation in penetration is of course known for the thalassaemia gene, whether inherited alone or together with an abnormal haemoglobin. Nevertheless, in this paper it seems that a clear distinction is not always made between mere haemoglobin E trait, and the combination of haemoglobin E trait and thalassaemia.]

Several cases are discussed at length. *H. Lehmann*

BRAIN, M. C. & VELLA, F. **Haemoglobin-H Trait in a Nepalese Gurkha Woman.** *Lancet.* 1958, Jan. 25, 192–4, 4 figs. [16 refs.]

After being treated for an apparent iron-deficiency anaemia with only slight improvement, a Gurkha woman of 24 in Singapore was found to carry haemoglobins A and H. As usual, the other clinico-pathological findings resembled those of thalassaemia minor; the Hb was 30%, and no Hb F was present. None of her relations was available for study except her child, whose haemoglobin was normal up to the age of 6 months.

The intra-erythrocytic inclusion bodies typical of this disease could be demonstrated in 40% of circulating erythrocytes, but in only 1% of red cells in the marrow, and not at all in the cytoplasm of nucleated red cell precursors. This is cited as evidence that they result from intracellular degradation of the haemoglobin. *Alan B. Raper*

VENOMS AND ANTIVENENES

MOHAMMED, A. H. & ZAKI, O. **Effects of Egyptian Black Snake Toxin on Ascorbic Acid of Adrenal Cortex and on Eosinophil Levels.** *Indian J. Med. Res.* 1958, Jan., v. 46, No. 1, 43–6. [14 refs.]

"1. A sublethal dose of Egyptian black snake toxin caused a marked eosinopenia, together with depletion of adrenal ascorbic acid in rats. Both effects are ascribed to hyper-activity of the suprarenal cortex, the toxin acting as a type of stress.

" 2. Injection of a lethal dose of toxin was associated with a significant eosinophilia, yet in most experiments there was no change or a slight increase in ascorbic-acid content of the adrenals. The eosinophilia obtained is interpreted as suggesting inhibition of the adrenal cortex."

TOXOPLASMOSIS

JACOBS, L. **The Interrelation of Toxoplasmosis in Swine, Cattle, Dogs, and Man.** *Pub. Health Rep.* Wash. 1957, Oct., v. 72, No. 10, 872–82, 2 figs. [42 refs.]

As stated in the heading of this paper, this is a " broad survey of information on the epidemiology of toxoplasmosis with an evaluation of data on the transmission ".

After a brief description of the organism as seen in the acute infection and within the " pseudocysts " associated with the chronic infection, the author discusses the very wide host range of the parasite. These natural hosts include such widely different animals as members of the Primates, Artiodactyla, Carnivora, Rodentia, Marsupialia and the birds: there are reports of infections among the Reptilia but natural infections of these animals have yet to be confirmed by isolation of the parasite.

Toxoplasmosis may occur in endemic and epidemic form in various animal populations: the latter type of infection has occurred on pigeon, rabbit, chicken and chinchilla farms and in cattle and pigs. Accumulated data suggest that infection is more prevalent in warm, moist climates rather than cold, or hot, dry areas. Fortunately the active disease in man appears to be only sporadic, although his contact with the parasite must be extensive as indicated by serological evidence. The author mentions, for example, that " Tahiti shows almost 70 per cent infected " [presumably it is meant here that 70% of the population possess antibodies against *Toxoplasma*].

Before discussing the possible sources of infection for man, the author briefly describes the characteristics of the acute infection. He mentions that the " proliferative " forms of *Toxoplasma* have been found in urine, faeces, milk and saliva from acutely infected animals, but that such free forms are very delicate. It appears that only under exceptional circumstances can transmission be effected from sick animals.

The persistence of the parasite in " pseudocysts " is characteristic of the chronic infection and the author cites examples where *Toxoplasma* has persisted for as long as 3 years in the brains of mice, rats and pigeons [the abstracter has recently isolated the RH strain of *Toxoplasma* from the brain of a guineapig inoculated 5 years previously (in press)]. There is evidence that within the " pseudocyst " the organism may be considerably protected.

Variations in the virulence of different strains of *Toxoplasma* are discussed, with the observation that strains isolated from sick animals in nature are usually virulent in experimental hosts, while those from apparently healthy animals usually produce asymptomatic infections in laboratory animals [see also this *Bulletin*, 1956, v. 53, 1168].

Toxoplasma infection in dogs is considered at some length and cases are mentioned in which there has been close contact between sick animals and infected human beings. The disease in swine and cattle has only more recently been recognized. The infectivity of the edible carcass from such animals has been demonstrated in 11 of 50 pigs from a Baltimore abattoir: a similar survey is being conducted on beef.

R. Lainson

Piekarski, G., Seeliger, H. P. R. & Saathoff, M. Zur Frage der Spezifität der *Toxoplasma*-Seroreaktionen. (Über die Beziehungen zwischen *Toxoplasma*- und *Listeria*-Antikörpern.) [**Specificity of the Serological Findings in Toxoplasmosis. Relationships between *Toxoplasma* and *Listeria* [*Erysipelothrix*] Antibodies**] *Ztschr. f. Hyg. u. Infektionskr.* 1957, v. 144, No. 3, 202–14, 1 fig. [Numerous refs.]

Antibodies to several other infective agents have been thought, incorrectly, to interfere with the serological tests for toxoplasmosis. The latest organism claimed to give cross reactions with *Toxoplasma gondii* is *Listeria* [*Erysipelothrix*] *monocytogenes*. In this paper the serological findings from 861 patients tested against toxoplasms and *Listeria* are presented. By far the greatest number of findings were negative for both organisms or had antibodies against only one of them. The number containing antibodies to both toxoplasms and *Listeria* was small and these were presumed to be due to a double infection. It was concluded that there was no cross reaction between toxoplasms and *Listeria*.

I. A. B. Cathie

Frenkel, J. K. & Hitchings, G. H. **Relative Reversal by Vitamins (*p*-Aminobenzoic, Folic, and Folinic Acids) of the Effects of Sulfadiazine and Pyrimethamine on *Toxoplasma*, Mouse and Man.** *Antibiotics & Chemotherapy.* New York. 1957, Dec., v. 7, No. 12, 630–38, 3 figs. [24 refs.]

Work by Eyles and Coleman [this *Bulletin*, 1956, v. 53, 367] had shown that a combination of sulphadiazine and pyrimethamine was the most effective treatment known for experimental toxoplasmosis of mice, but when this treatment (2 gm. sulphadiazine and 25 mgm. pyrimethamine daily for several weeks) was given to patients with ocular toxoplasmosis, most of them showed thrombocytopenia and leucopenia. Accordingly investigations were made to see if the toxic effects could be diminished by suitable vitamins without destroying the therapeutic

effect. Mice were infected intraperitoneally with virulent toxoplasmas and treated by drugs incorporated in the diet. The mice weighed 20 gm. and consumed 3·5 gm. of the diet per day. *P*-aminobenzoic acid (0·1% in diet) suppressed almost completely the therapeutic actions of both sulphadiazine and pyrimethamine. Folic acid in large doses (0·06% in diet) antagonized each drug moderately; folinic acid (0·006%) did not antagonize either drug to a significant effect, and it also diminished the toxic effect of the drugs on the mice. In further experiments yeast (0·3% or 3·0%) was added to the diet. This contributed folic acid and folinic acid but did not diminish the therapeutic effects of the standard drugs. The development of toxoplasma infections in nursling rats was not diminished by giving a milk diet, nor was it accelerated by giving *p*-aminobenzoic acid. Patients who experienced depression of platelets and leucocytes while being treated with pyrimethamine and sulphadiazine rapidly returned to normal when folinic acid was given with or without the withdrawal of the drugs. It is recommended that when patients are treated with pyrimethamine and sulphadiazine they should also be given 5 mgm. folinic acid daily, which may be supplemented with one or two yeast cakes. Alternatively derivatives of liver or yeast might be administered. *F. Hawking*

DERMATOLOGY AND FUNGUS DISEASES

See also p. 596, Prívora & Samšinák, Milben als Menschenplage. [**Mites as Pests of Man**]

Wheeler, C. E. & Cawley, E. P. **An Unusual Case of Blastomycosis occurring during Pregnancy.** *Arch. Dermat.* 1958, Jan., v. 77, No. 1, 120–22, 2 figs.

"During the fifth month of pregnancy a 33-year-old white woman developed blastomycosis which was unusual in three respects: (1) The skin lesion was chancriform; (2) there was regional lymphadenopathy, and (3) the disease involuted without treatment."

Reyes, O. & Borelli, D. Un caso de micetoma podal por *Madurella grisea.* [**A Case of Mycetoma of the Foot Caused by** *Madurella grisea*] *Rev. Sanidad y Asistencia Social.* Caracas. 1957, Sept.–Dec., v. 22, Nos. 5/6, 445–56, 17 figs. on 6 pls. [17 refs.]

The English summary appended to the paper is as follows:—

"A case of black-grained mycetoma of the foot of eight years duration in a mestizo woman from the northern-central part of Venezuela is

described. The morphology of the parasitic and cultural phases of the causal agent is treated in detail; identification to the species *Madurella grisea* MacKinnon, Ferrada et Montemayor is established.

"Therapy with 4-4 diamino-diphenyl-sulfone ended in failure."

[This is believed to be only the second case reported in Venezuela.]

Borelli, D. *Madurella mycetomi*: Fialides, Fialosporos, inoculación al raton. [*Madurella mycetomi*: **Phialides, Phialospores. Inoculation in the Mouse**] Reprinted from *Bol. Laboratorio Clínico*. 1957, Jan.–June, v. 2, Nos. 1/2, 15 pp., 16 figs. [22 refs.] English summary.

The original definition of the genus *Madurella* Brumpt 1905, based only on the character of the fungus in parasitic life, was inadequate and led to much confusion, with the naming of many apparently new species which have now passed to the synonymy of *Madurella mycetomi*. Negroni *et al.* [this *Bulletin*, 1948, v. 45, 110], Mackinnon [*ibid.*, 1952, v. 49, 994] and Lacaz and Netto [*ibid.*, 1957, v. 54, 86] have done much to clarify the nomenclature of the species. Abbott [*ibid.*, 1956, v. 53, 802], however, was the first to describe a conidial form in a strain previously identified as *M. mycetomi*, and he emended the generic diagnosis accordingly. Maberti and Borelli [*ibid.*, 1958, v. 55, 91] have recently described the conidial form of *M. mycetomi* in a strain isolated from mycetoma in Venezuela.

In the present report Borelli describes his further studies on the Venezuelan strain referred to and another strain of *M. mycetomi* isolated in the Sudan. In this work the glucose peptone milk agar medium (Sablac) described by Maberti and Borelli [*loc. cit.*] was found particularly useful. Apart from a difference in proteolytic power, the two strains under investigation were found to agree in all important respects. Both showed an abundant development of conidia of the type *Monosporium* carried, often in groups of 2–4 units, on the tip of a slender and straight sporophore arising obliquely from a similarly slender and straight hypha. These are the conidia described by Abbott [*loc. cit.*] but he found them only in the submerged growth of a culture on soil-infusion agar, whereas in the present study they were seen to develop on the aerial mycelium and the trailing mycelium on the surface of the medium, in slope or slide cultures on Sablac agar at 37°C. An entirely new and very important observation was the development of phialides and phialospores, apparently of the type *Phialophora*, similar to those described by Emmons [*ibid.*, 1945, v. 42, 833] in *Phialophora jeanselmei*, a rare cause of mycetoma, and by the present author in *Hormiscium dermatitidis* and *Cladosporium gougeroti*. The phialospores, in short chains, cohering because of a mucilaginous covering, form a rosebud-shaped mass on the tip of the parent phialide which may be straight, bottle-shaped or flask-shaped, is never provided with a cup or collarette and has a contracted mouth. The spore mass is described as *Cephalosporium*-like, which need not imply

that the spores are not semi-endogenous. The author's new observation is of great taxonomic importance and would link *M. mycetomi* with the genus *Phialophora*, species of which cause both mycetoma and chromoblastomycosis. He considers that the genus *Madurella* should further be emended to include the production of phialospores, but the revision of its taxonomic position is a matter for an authoritative body.

In the same report the author describes the experimental infection of mice by inoculation with a culture of *M. mycetomi*. To effect this it was necessary to provide a granulomatous soil with an abundance of macrophages and histiocytes in which the fungal inoculum could develop and become adapted to parasitic life. Mice were therefore inoculated, into the peritoneum, simultaneously with suspensions of *M. mycetomi* and the yeast phase of either *Histoplasma capsulatum* or *Blastomyces dermatitidis* which provoked the appropriate cellular reaction. The little black grains of *M. mycetomi*, which could be seen in the tissue in the third week after inoculation, presented all the characteristics peculiar to the grain of *M. mycetomi* as seen in mycetoma of man. This is a notable achievement. ***J. T. Duncan***

MACKINNON, J. E., ARTAGAVEYTIA-ALLENDE, R. C. & GARCÍA-ZORRÓN, Noemí. **The Inhibitory Effect of Chemotherapeutic Agents on the Growth of the Causal Organisms of Exogenous Mycetomas and Nocardiosis.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958. Jan., v. 52, No. 1, 78–86. [41 refs.]

Assays of the inhibitory power, *in vitro*, of 13 different chemical compounds on the growth of 36 strains of 10 species of actinomycetes and fungi which cause mycetoma, encourage the hope that an effective chemotherapy of the disease will be developed. The tests were made, generally in the presence of 20% horse serum, in solid media (Krainsky's agar, nutrient glucose agar and "Sabouraud" glucose agar). Sowings of the micro-organisms were made on the surface of the media containing definite concentrations of the drugs, and recordings of growth were made after 7 days' incubation at 30°C., but in the case of the antibiotic mycostatin, which deteriorates rather quickly in the medium, the readings were made after the third day. Some differences in the degree of sensitivity to particular drugs were sometimes shown among the strains of a single species, but, on the whole, it was possible to assess the action of the drug on the species.

Inhibition of growth was caused by the following drugs on the micro-organisms stated:

Penicillin on *Streptomyces pelletieri* at 1–3 or at 3–6 μgm./ml., on *S. somaliensis* at 3–6 or 6–12 μgm./ml.

Streptomycin on *S. somaliensis* at 0·1–1·0 μgm./ml.; and on some strains of *S. madurae* at 1·0–2·0 μgm./ml. There was, however, a tendency to show acquired resistance to this antibiotic.

Cycloheximide on *Madurella mycetomi*, *M. grisea* and *Phialophora jeanselmei* at 200 μgm./ml. and possibly lower concentrations.

Aureomycin on *S. madurae*, *S. pelletieri* and *S. somaliensis* at 0·5–1·0 μgm./ml. but rather equivocal results on species of *Nocardia*.

Chloramphenicol on *S. somaliensis* at 0·5–5·0 μgm./ml.

Mycostatin on *M. mycetomi*, *M. grisea* and *P. jeanselmei* at 20 μgm./ml. but only slight effect on *Allescheria boydii* and *Cephalosporium falciforme* and none on any of the actinomycetes.

Sulphathiazole on *S. madurae*, *Nocardia asteroides* and *N. brasiliensis* generally at 1–2 μgm./ml.

Sulphone or dapsone (DDS) had a moderate inhibitory effect on *S. madurae*, *S. somaliensis*, *N. asteroides* and *N. brasiliensis*, and a low effect on *M. mycetomi* and *M. grisea*.

Dichlordiphenylsulphide on all of the actinomycetes at 1–5 μgm./ml. in the absence of serum and at 100–200 μgm./ml. in presence of serum; on all of the moulds except *C. falciforme* at 2–20 μgm./ml. without serum and 20–50 μgm./ml. with serum. *M. mycetomi* was less sensitive than *M. grisea*, *P. jeanselmei* and *A. boydii*.

Of the aromatic diamidines, diamidinodiphenylamine was effective against *S. madurae*, *M. mycetomi*, *M. grisea*, *P. jeanselmei* and *A. boydii* and moderately so against all the other actinomycetes. Abbott [this *Bulletin*, 1956, v. 53, 802] found it active against *M. mycetomi in vitro* but not *in vivo* when used therapeutically in mycetoma. *J. T. Duncan*

✓ Ward, J. R. & Hunter, R. C., Jr. **Disseminated Coccidioidomycosis demonstrated by Needle Biopsy of the Liver.** *Ann. Intern. Med.* 1958, Jan., v. 48, No. 1, 157–63, 3 figs. [25 refs.]

"1. A case has been presented of disseminated coccidioidomycosis with the unusual feature that the organism, *Coccidioides immitis*, was revealed by needle biopsy of the liver.

"2. Liver biopsy may be helpful in the differential diagnosis of disseminated coccidioidomycosis, whether hepatomegaly is present or not."

Melick, D. W. **The Surgical Treatment of Pulmonary Coccidioidomycosis with a Comprehensive Summary of the Complications following this Type of Therapy.** *Amer. Rev. Tuberculosis.* 1958, Jan., v. 77, No. 1, 17–21.

"Surgical therapy in pulmonary coccidioidomycosis is a well-recognized procedure within the indications herein outlined. Four hundred cases have been collected. Especial attention has been given to the rate of complications in this group of cases, which has been found to be 13 per cent. In certain case reports by other writers, the complication rate is less than 5 per cent. In the present report, a group of 54 cases is

reviewed, in which the complication rate was 18 per cent. Complications, when they do occur, can be expected to be severe in one of every two cases. These complications, major or minor, are a confirmation of the fact there is no good antifungal agent to assist in the protection of the patient when surgery is performed. The necessity for surgery will be lessened when such an antifungal agent is available."

MACKINNON, J. E., ARTAGAVEYTIA-ALLENDE, R. C. & GARCÍA-ZORRÓN, Noemí. **M & B 938 in Experimental Coccidioidomycosis in Mice.** [Correspondence.] *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Jan., v. 52, No. 1, 92–3.

The aromatic diamidine diamidinodiphenylamine dihydrochloride (M & B 938), referred to by MACKINNON *et al.* [above] in connexion with the fungi of mycetoma, was found to be fungistatic to *Coccidioides immitis*, *in vitro*, at concentrations from 2–5 μgm./ml. in the culture medium in the presence of 20% horse serum. By tests *in vivo* with mice experimentally infected with *C. immitis*, it is shown to have a definite, if limited, therapeutic action against the infection.

Mice inoculated intravenously with a light but lethal dose of mycelium and spores of *C. immitis* from a culture, were treated, from the time of inoculation, with M & B 938 in a dose of 0·4 mgm. given subcutaneously each day for 30 days. After an interval of 10 days the course of treatment was repeated. 10 of 14 animals survived the period of the test and although miliary lesions were present in the lungs in all, culture tests showed the infection to have been eradicated in 6 of these survivors. Other mice were inoculated intravenously with a large dose of *C. immitis* in the spherule form from a semi-anaerobic culture. They were treated similarly to the first group but all died of the infection. However, the average survival time was much longer than in the control, untreated, animals, and in the last 2 survivors, which died with cerebral infection on the 29th and 40th days respectively, there were signs of healing of the pulmonary lesions. It seemed also that the drug prevented the transformation of the culture spherules directly into sporangia with endospores. In a third group of mice a similar large infecting dose of culture spherules was given into the peritoneum. Treatment with M & B 938, 0·4 mgm. daily, was commenced at the time of inoculation and continued for 40 days. There were no deaths in this period and all of the 18 treated animals were killed and examined on the 43rd day. None showed any metastatic pulmonary lesion but the fungus was isolated from the lung in 2 of 18 animals and from the peritoneal lesions in 13; in 5 the infection appeared to have been eradicated. Of the 18 control, untreated, mice, 6 died during the period of the experiment and the survivors were all actively infected.

In view of the failure of the treatment to prevent the establishment

of the infection, the authors consider that the cures effected must, in part, be attributed to the natural defence mechanism of the animal.

J. T. Duncan

TROPICAL OPHTHALMOLOGY

SOSA, T. Siebzig Jahre Trachom in Mitteldalmatien. [**Seventy Years Experience of Trachoma in Central Dalmatia**] *Rev. Internat. du Trachome.* 1957, v. 34, No. 4, 452–67. [31 refs.]

VELLIEUX, M. Données actuelles sur l'étiologie, l'épidémiologie et le traitement du trachome. Les conjonctivites épidémiques. [**Current Data on the Aetiology, Epidemiology and Treatment of Trachoma, with special reference to Epidemic Conjunctivitis**] *Rev. Internat. du Trachome.* 1957, v. 34, No. 4, 381–97.

The English summary appended to the paper is as follows:—

"After a short epidemiological account of trachomatous infestation, particularly in French West Africa, the author insists, from the point of view of pathogenesis, on the influence of both medium and conjoint conjunctival infections (studied with special reference to epidemical conjunctivitis), in the outbreak and the evolution of trachoma.

"He gives a short historical account of the various studies dealing with this disease; as a result of them, its specific agent can now be defined as occupying a borderline position between rickettsia and virus. He ends by reviewing the various mass or individual therapies now applied in French West Africa to fight this endemic disease."

NAKAJIMA, A. & OTAKE, T. **Studies on Trachoma. Part 1. Smear Cytology of the Conjunctival Epithelium in Trachoma and some other Diseases.** *Rev. Internat. du Trachome.* 1957, v. 34, No. 4, 398–416, 23 figs. [15 refs.] **Part 2. On some Bodily Symptoms of Acute and Chronic Trachoma.** *Ibid.*, 417–21. **Part 3. Epidemiology of Trachoma.** *Ibid.*, 422–38, 5 figs.

SMATI, A. L'activité des équipes ophtalmologiques mobiles et des secteurs ophtalmologiques en Algerie, pendant l'année 1955. [**Activity of Mobile Ophthalmological Teams and Stations in Algeria in 1955**] *Rev. Internat. du Trachome.* 1957, v. 34, No. 4, 468–97. 2 figs., 1 map & 1 chart.

See also p. 561, RODGER & BROWN, **Assessment of the Density of Infection with Onchocerciasis and the Probable Level of Safety from its Ocular Complications.**

HEAT STROKE AND ALLIED CONDITIONS

JELLIFFE, D. B. **Miliaria in Bengali Children in Calcutta City.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1958, Jan., v. 52, No. 1, 71–7. [17 refs.]

At a Health Centre in Calcutta 60 consecutive children of average age 2 years were examined for prickly heat in late April and May 1955. All the children were slum-dwelling Bengali, thin and poorly nourished. Daily maximum and minimum temperatures were 91–100°F. and 80–84°F. with 81–98% and 42–61% humidity respectively.

Of the total number, 97% showed prickly heat, in 30% involving less than one-quarter, in 40% between one-quarter and one-half and in 27% more than one-half of the body surface. All children in the severely affected group had mamillaria; a few had branny desquamation. The lower legs, palms, soles and axillae were never affected but the face was frequently involved.

In 4 of the most severely affected children interference with sweating was demonstrated by gentian violet powder. These were enclosed in a hot room with 4 normal children as controls.

It is concluded that miliaria may be more common among the general population of Calcutta than was previously supposed and that the associated hypohidrosis may account for some of the unexplained pyrexias, *e.g.*, " sleep fever ".

The literature is discussed at some length. *M. L. Thomson*

YAGLOU, C. P. & MINARD, D. **Control of Heat Casualties at Military Training Centers.** *Arch. Indust. Health.* Chicago. 1957, Oct., v. 16, No. 4, 302–16, 7 figs.

The endemicity of heat illness, with occasional loss of life, in U.S. Military Training Centres has previously been reported [this *Bulletin*, 1957, v. 54, 1363]. This paper describes methods of investigating what was the total heat stress imposed on men in three camps by physical training, temperature, radiation, humidity and wind. In addition, the limiting thermal conditions were ascertained at which symptoms of heat intolerance appeared, and those beyond which break-down would occur.

A new heat index, the wet-bulb-globe temperature, was used in place of effective temperature. For olive drab shades of military clothing it is 0·7 psychrometric wet bulb temperature and 0·3 black globe temperature.

It has been determined that an evaporative sweat loss of 1 kgm./hr., corresponding to theoretical heat loss of 580 Cal./hr., is about the maximum that can safely be tolerated by healthy young men acclimatized to heat and working 4–6 hours a day with a 10-minute rest pause every hour.

In this study heat strain was evaluated by increased pulse and body temperatures. In these tests evaporative sweat loss showed a correlation

with globe temperatures, and other indices based thereon, which was significantly higher than with dry or wet bulb temperature. Solar radiation was, therefore, the most important climatic factor.

The remainder of this paper presents an analysis of heat casualties by clinical variety, thermal conditions, type of recruit and their degree of acclimatization to heat. Heat cramps had low morbidity and no mortality. Heat exhaustion (or prostration) had high incidence and associated sick days but no deaths. Heat stroke was only one-tenth as common as heat exhaustion but had caused 6 deaths in the last 3 years.

Heat rash (miliaria) was prevalent above certain temperatures unless the men were exposed for a few hours a day, *e.g.*, in sleeping quarters, to temperatures just cool enough to stop sweating.

In 1954 instructions were issued for prevention of heat disease. The main recommendations were as follows:—

(a) acclimatization period of 1 to 3 weeks for new recruits;
(b) special training for obese trainees;
(c) trial of air-conditioned barracks;
(d) training programmes to be planned on a simple heat index, such as wet-bulb-globe temperature; when this reached 80°F. the time of field exercises was limited for new trainees; at 85°F. it ceased for new trainees and was curtailed for all; at 88°F. all physical training was stopped.

In 1954 the incidence of heat casualties was greatly reduced, owing at least in part, to the implementation of the above recommendations.

M. L. Thomson

Minard, D., Belding, H. S. & Kingston, J. R. **Prevention of Heat Casualties.** *J. Amer. Med. Ass.* 1957, Dec. 7, v. 165, No. 14, 1813–18, 1 fig.

This paper reports the incidence and severity of heat casualties during 1955 and 1956 after the introduction of remedial measures designed as the result of field studies made in 1954 and 1955 [see above].

The regulations were further modified in 1956, as follows. The yellow flag, denoting moderate climatic heat and requiring curtailment of active outdoor drill for all recruits, was flown when wet-bulb-globe temperature index (WBGT) lay between 85 and 87·9°F.: a red flag now indicated WBGT greater than 88°F. and required suspension of all outdoor instruction other than sedentary work in the shade (WBGT is 0·7 wet bulb + 0·1 dry bulb + 0·2 globe temperatures. The wet bulb is not artificially ventilated). Aluminium painted helmet liners were introduced in place of cloth liners.

The summer of 1956 was hotter than 1955 having 44% more working hours in the heat stress zone (WBGT greater than 88°F.) than 1955. In spite of this the mean weekly incidence of heat casualties was 12·4/10,000 in 1955 as compared with 4·67/10,000 in 1956, the difference being highly significant.

M. L. Thomson

MISCELLANEOUS DISEASES

DUJMUŠIĆ, T. Tri slučaja skleroma podrijetlom iz Istre. [**Three Cases of Rhinoscleroma occurring in Istria**] *Radovi Med. Fakul. Zagreb.* 1957, v. 2, 137–52. [Numerous refs.] German summary.

Rhinoscleroma was first recognized in Jugoslavia in 1904; by 1931, 136 cases had been reported, and it became apparent that an endemic focus of infection existed in the neighbourhood of Ljubljana. The author now describes 3 cases of the disease occurring in a family living in Istria, a province in which rhinoscleroma had not previously been known to occur. From the history it appeared that the father had become infected during the war while fighting as a partisan in the neighbourhood of the focus of infection, and had then infected his wife and son after returning home. *D. J. Bauer*

LAURIE, W. & WOODS, J. D. **Atherosclerosis and its Cerebral Complications in the South African Bantu.** *Lancet.* 1958, Feb. 1, 231–2. [13 refs.]

"The prevalence of atherosclerosis of the aorta in necropsy examinations in 300 adult South African Bantu shows that aortic atherosclerosis is relatively common in this race. 31 patients were found at necropsy to have cerebral haemorrhage or thrombosis. Out of 5700 medical admissions, there were 37 patients in whom the same diagnosis was made but who did not come to necropsy." [See this *Bulletin*, 1946, v. 43, 1076; 1955, v. 52, 189, 689.]

PYÖRÄLÄ, K., PUNSAR, S., SEPPÄLÄ, T. & KARLSSON, K. **Mucopolysaccharides of the Aorta and Epiphyseal Cartilage in Lathyritic Growing Rats and Rat Fetuses.** *Acta Path. et Microb. Scandinavica.* 1957, v. 41, No. 6, 497–510, 14 figs. [47 refs.]

PARASITOLOGY: GENERAL

MACLEAN, R. D. **Imported Intestinal Parasites.** *Med. Officer.* 1958. Jan. 31, v. 99, No. 5, 61–2. [11 refs.]

Since 1937, the Metropolitan Water Board has made a routine examination of water works employees for detection of carriers of waterborne diseases, mainly bacterial infections. As a result of the recent influx of workers from tropical countries it was decided to add microscopical

examination of the stools to routine culture examinations in the case of all workers from overseas: parallel examinations were made of the stools of workers born and bred in Britain, whose specimens had been submitted to bacteriological examination. The examinations were made on direct smears, both in saline and in iodine.

Among the first 21 coloured workers examined, intestinal parasites were found in 14, all from Jamaica except one who was from Antigua. The parasites were *Ascaris* ova (8), *Trichuris* ova (5), *Ancylostoma* ova (6), *Entamoeba coli* cysts (3), *E. histolytica*, *Giardia* and *Iodamoeba bütschlii* (1 each).

None of the workers had any complaints. 4 gave histories of worms in childhood, one of those with hookworm had had it 16 years previously, one had smallpox in 1947 and one had yaws as a child. The patient with *E. histolytica* cysts had had dysentery in 1939.

Most of the men came from rural areas in the West Indies. They had been in Britain for periods ranging from a few weeks to 5 years. In 32 stool examinations from 32 British-born employees, a heavy infection with *Giardia* was found in one. This patient had been suffering from gastro-enteritis.

The author discusses these findings and points out that *Ascaris*, *Trichuris* and *E. histolytica* may be spread by polluted water and that cysts of the last-named completely resist chlorination at the bactericidal levels usual in water purification.

The author felt that these preliminary findings justified their publication for the benefit of medical officers whom they would concern, especially those connected with industries such as mining and food and water undertakings where workers from tropical countries may be employed. The actual risk will depend on the hygienic habits of the infected employee, but it should be borne in mind.

The author corrects the erroneous assumption that such immigrants are medically examined either before leaving home or on arrival in Britain. The Aliens Orders do not apply to British territories overseas, and in the case of most of the immigrants therefrom no such examination takes place. *H. J. O'D. Burke-Gaffney*

VIVES, N. & ZELEDÓN, R. Observaciones parasitológicas en ratas de San José, Costa Rica. [**Parasitological Observations on Rats in San José, Costa Rica**] *Rev. Biologia Trop.* San José, Costa Rica. 1957, Dec., v. 5, No. 2, 173–94, 1 graph & 18 figs. [28 refs.] English summary.

The authors made a parasitological study of 103 house-rats in San José, Costa Rica. 7 were *R. rattus* and the rest were *R. norvegicus*.

5 species of protozoa were found in the faeces and these included *Trichomonas*, *Giardia*, *Entamoeba* and *Chilomastix*. *Trypanosoma lewisi* was found in the blood of 7 of 17 rats. 9 species of helminth found included *Hymenolepis nana* (0·9%) and *H. diminuta* (43·6%). No

Trichinella larvae were detected in diaphragms examined. 3 species of arthropods collected included *Xenopsylla cheopis* (7·7%) and *Ctenopsyllus segnis* (1·9%).

The results are shown in a graph and 5 tables, one of which compares the findings of helminths with those in 4 South American countries, Mexico, 3 areas in the United States, Canada, the Philippines and France.

Appearances of some of the parasites are shown in 18 figures.

H. J. O'D. Burke-Gaffney

HOWARD, R. M. & SHELDON, W. H. **Pneumocystis Pneumonia. Report of a Case.** *J. Dis. Children.* Chicago. 1958, Jan., v. 95, No. 1, Pt. 1, 18–24, 5 figs. [16 refs.]

"An isolated case of Pneumocystis carinii pneumonia is described in a 7-months-old white native American boy. The organisms were identified in histologic sections and in imprint smears of the lung."

[For other cases in American infants, see this *Bulletin*, 1956, v. 53, 1491; 1957, v. 54, 624.]

ENTOMOLOGY AND INSECTICIDES: GENERAL ZOOLOGY

[Papers on the toxic effects of insecticides in man are abstracted in the *Bulletin of Hygiene* under the general heading of Occupational Hygiene and Toxicology.]

ABDEL-MALEK, A. **Mosquitoes of North-Eastern Sinaï.** *Bull. Soc. Entom. Egypte.* 1956, v. 40, 97–107. [18 refs.]

"A collection of mosquito larvae made in August 1951 in north-eastern Sinai is the basis for this paper. Biological and distributional notes are given for the twelve species collected. Two species new to this region were encountered, namely, *Uranotaenia unguiculata* Edwards and *Aedes* (*Ochlerotatus*) *caspius* Pallas. Simple keys for the identification of the [7] Anopheline and [12] Culicine larvae so far recorded from Sinai are devised."

GAD, A. M. **Mosquitoes of the Oases of the Libyan Desert of Egypt.** *Bull. Soc. Entom. Egypte.* 1956, v. 40, 131–6.

Brief notes are given on the biology and distribution of 5 anopheline and 11 culicine mosquitoes recorded from the oases of Siwa, Bahria, Kharga and Dakhla.

H. S. Leeson

PEYTON, E. L. & HILL, S. O. **Keys to the Genera of Larvae and Adult Mosquitoes of the United States.** *Mosquito News.* 1957, Dec., v. 17, No. 4, 294–6.

NIEBANCK, L. **Observations on Mosquito Species in Nassau County, Long Island, N.Y., based on Larval and Adult Collections during the Ten-Year Period 1947–1956.** *Mosquito News.* 1957, Dec., v. 17, No. 4, 315–18.

MUSPRATT, J. **The *Stegomyia* Mosquitoes of South Africa and some Neighbouring Territories. Including Chapters on the Mosquito-Borne Virus Diseases of the Ethiopian Zoo-Geographical Region of Africa.** *Mem. Entom. Soc. Southern Africa.* 1956, July, No. 4, 138 pp., 20 pls. Pretoria: P.O. Box 103. [15s.]

This work presents in a useful compact way an account of the recognition, biology and relationship to important diseases of mosquitoes of the genus *Aëdes* (subgenus *Stegomyia*) in South Africa and neighbouring protectorates. Taxonomy and distribution are based on the author's own studies in the past 5 years or so and collections by others at the South African Institute for Medical Research. Opinion and assistance in these matters have been given by Dr. B. DE MEILLON of the Institute and Mr. P. F. MATTINGLY of the British Museum. Other workers of standing, on mosquitoes in relation to disease, are also acknowledged for their assistance in different ways.

The work is intended to encourage collection of the group in southern Africa by health officers and others. About a half of the text is on the systematics of the 17 species recorded. There is an account of the terminology of adult and larval *Stegomyia* preceding keys to them. It is preferable, however, to breed out to adults rather than rely on identification from larvae. Collecting and preserving methods are fully described.

Each species is separately described, with good line illustrations of the female, larval characters, and where necessary male terminalia. There is a "differential diagnosis" for each species which should be particularly helpful in guiding the collector new to the group. Bionomics and ecology are also summarized for each species, and this is selective not only of field data but of laboratory data which are relevant to a concept of the biology of the species as a whole. The relationship of each species to the transmission of disease is also discussed from the literature, and again both field and laboratory information is taken into account. Four photographs illustrate breeding places in plant axils or tree-holes (including *Aëdes aegypti* in a baobab). Six excellent maps show the recorded distribution of all the species; a detailed table of the records and notes on distribution under species amplify the maps. There are separate chapters on *Stegomyia* mosquitoes with regard to their association with mosquito-borne viruses in Africa as a whole, and the bearing of this association on disease transmission in southern Africa. This is based on a selection of leading publications of the past 25 years. Here is found a digest of work and findings on the transmission of yellow fever, Rift Valley fever, and dengue with note only being taken of the numerous

other viruses associated to a greater or lesser extent with this group of mosquitoes in the past decade or so.

With reference to southern Africa it is emphasized that the area contains potential vectors of yellow fever, an actual vector of Rift Valley fever and another potential vector. *Aëdes aegypti* also is capable of transmitting dengue. The possible means of virus being introduced to southern Africa are defined—transport of mosquitoes, carriers and possibly migrant birds. In general, safeguards against the first two possibilities are considered satisfactory. South African territories are well outside the southernmost limit of yellow fever and adjacent territories have few records of positive sera. Dengue was last recorded in the area from Durban in 1927. Rift Valley fever has been recognized in different parts of South Africa since 1951. The viruses of horse-sickness and of blue-tongue in sheep of South Africa are now accepted as transmitted not by mosquitoes but by *Culicoides* midges. *D. S. Bertram*

SINGH, K. R. P. & BROWN, A. W. A. **Nutritional Requirements of** *Aedes aegypti* **L.** *J. Insect Physiol.* London. 1957, Nov., v. 1, No. 3, 199–220. [Numerous refs.]

The nutritional requirements of *Aëdes aegypti* have been investigated throughout the complete life cycle.

Larvae were reared on a chemically defined diet consisting of glucose, three lipids, 17 amino-acids, RNA (ribonucleic acid), glutathione, 12 vitamins and a salt mixture (MD No. 185 hatching solution). Provided that the osmotic pressure (measured as freezing-point depressions) did not exceed Δ 0·4°C., healthy larvae, pupae and adults were produced. Aseptic conditions were maintained up to the time when the adults emerged. Such adults layed viable eggs when fed with a mixture of 12 amino-acids with glucose or fructose.

The following 10 amino-acids were found indispensable for both adult and larval nutrition: arginine, isoleucine, leucine, lysine, phenylalanine, methionine, threonine, tryptophan, valine and histidine; these are the same as those essential for mammalian nutrition.

Although vitamins were not required in adult nutrition, 9 formed an essential part of the larval diet. *R. J. Wood*

SINGH, K. R. P. & MICKS, D. W. **Synthesis of Amino Acids in** *Aedes aegypti* **L.** *Mosquito News.* 1957, Dec., v. 17, No. 4, 248–51, 1 fig. [10 refs.]

"*Aedes aegypti* larvae were reared on a completely chemically-defined diet under aseptic conditions. Non-essential amino acids (alanine, glycine, serine, tyrosine, cystine and proline) when omitted individually from the diet were present on two-dimensional chromatograms of larvae of this strain, indicating amino acid synthesis.

"A quantitative chromatographic comparison of the chemical diet strain with the regular laboratory strain revealed marked differences between the two as to concentrations of certain amino acids, particularly the non-essential ones."

TERZIAN, L. A., IRREVERRE, F. & STAHLER, N. **A Study of Nitrogen and Uric Acid Patterns in the Excreta and Body Tissues of Adult** *Aedes aegypti*. *J. Insect Physiol.* London. 1957, Nov., v. 1, No. 3, 221–8, 3 figs.

Studies of nitrogen metabolism in adult *Aëdes aegypti* show that immediately after emergence there occurs a considerable excretion of nitrogenous material. This has been identified by chemical, physical and biochemical methods as consisting principally of uric acid. Since the output of uric acid decreases rapidly thereafter, provided the insect is maintained on a diet of sucrose alone, it is suggested that immediately after emergence the adults are excreting the products of pupal metamorphosis. If, a week or more later, a blood meal is given, the level of uric acid excreted rises immediately and to a level comparable with that reached just after emergence. If, however, the insect is maintained on plasma or lysed red cells, only a small part of the increase in excreted nitrogen is uric acid. This suggests that ingested proteins are utilized by the mosquito only if they are converted to and excreted as uric acid. A study of the comparative tissue nitrogen levels of mosquitoes maintained on these diets supports this.

The data also suggests that, in the absence of any egg-laying activity, all the protein necessary for adult existence is obtained by the female during the larval developmental period. *R. J. Wood*

LUMSDEN, W. H. R. **The Activity Cycle of Domestic** *Aëdes* (*Stegomyia*) *aegypti* **(L.) (Dipt., Culicid.) in Southern Province, Tanganyika.** *Bull. Entom. Res.* 1957, Dec., v. 48, Pt. 4, 769–82, 2 figs. [27 refs.]

While a virus epidemic was being investigated in Newala district of Southern Tanganyika [this *Bulletin*, 1955, v. 52, 442] a continuous 49-hour catch of *Aëdes aegypti* biting bait boys was carried out. The results, based on a total catch of 2,594 females and 603 males are dealt with in this paper. The catches were made inside and on the verandah of one typical hut normally occupied by two people. The mosquito bred abundantly in the numerous water pots in the African huts and was accompanied by larvae of *Culex p. fatigans*. Adults of the latter were also taken, but, from precipitin tests, *C. p. fatigans* appeared to feed more on fowls than man. As regards *Aëdes aegypti*, about two-thirds of the biting occurs by day and one-third by night, this being applicable to both indoor and verandah catches. Indoors, four main peaks of biting

occurred—0300 to 0400 hours, 0800 to 0900 hours, 1400 to 1500 hours, and 2100 to 2200 hours. On the verandah, six waves or peaks of biting were observed. The two waves additional to these indoors are about sunrise and sunset.

There is a very full discussion of the results in terms of possible factors inducing these waves of activity. Detailed consideration is given to the publications of others on this topic in relation to *Aëdes aegypti* and other mosquitoes. The general conclusion is that further work on the ages of mosquitoes in periodic catches, intrinsic rhythms and the periodicity of other activities (*e.g.*, mating, oviposition) are likely to be profitable in elucidating the causes of rhythmical biting cycles. *D. S. Bertram*

BURGESS, L. & BROWN, A. W. A. **Studies on the Responses of the Female *Aëdes* Mosquito. Part VIII. The Attractiveness of Beef Blood to *Aëdes aegypti* (L.).** *Bull. Entom. Res.* 1957, Dec., v. 48, Pt. 4, 783–93, 2 figs.

This is an interesting extension of a long series of studies, abstracted earlier in this *Bulletin* [1952, v. 49, 196, 322, 323; 1953, v. 50, 571; 1954, v. 51, 848; 1956, v. 53, 1058], on factors attracting a mosquito to approach and to bite its host. Work by others indicated that the blood of an animal contained attractant components; fresh blood, citrated or defibrinated blood but not dry blood evoked response in mosquitoes. The present work considers this problem with special reference to the attractant factor in the carbon dioxide and other fractions of blood. Cattle blood was used and was heparinized and kept refrigerated until required. The apparatus used is described in some detail. Results were recorded in terms of numbers of *Aëdes aegypti* attracted to a focus of the test constituent and a suitable control focus in a cage up to 10 × 4½ × 8 ft. capacity. General conditions were 80°–85°F. temperature and 50–70% relative humidity. Attractiveness was expressed by an "Attractiveness Ratio" (AR), being the number of mosquitoes attracted to the test material divided by the number attracted to the control focus. Statistical tests were applied throughout.

It is shown, first, that whole blood is more attractive than water and that this is an effect of the plasma rather than the corpuscles. Moreover, vapour from blood was more attractive than water vapour. There were, however, some considerable variations between different tests and this, on further study, was in some measure shown to be an effect of mosquito age. The response to an attractant source was highest (3·84 AR) on the second day after emergence, and declined to 2 by the eighth day. Levels between 2 and 1 continued until the seventeenth day, by which time the mosquitoes took no interest in rabbits or the human arm offered for a blood meal. In continuation of the tests, all carbon dioxide was removed (methods indicated) from blood and this was found to result in a loss of the attractiveness to mosquitoes. (An important note made

is that the method of removing carbon dioxide by vacuum must remove other volatile constituents.) It is then shown that blood treated as above and then reconstituted with added carbon dioxide (up to excess) recovers only a fraction of the attractiveness of whole blood. These results so far are for liquid samples. Further tests show that blood vapour, free of carbon dioxide, also loses its attractiveness. Next, whole blood was distilled under vacuum conditions, giving a concentrate of volatile constituents. This proved significantly attractive (AR 1·49) but only for the first 8 minutes of the tests. If this condensate was heated, attractiveness could not be demonstrated; this suggested rapid loss of effective attractant or attractants by volatilization. The residue of the vacuum distillation was then also tested and proved highly attractive. Indeed, the greater part of attractant power had been retained in the residue and little had passed over as distillates. Whatever was present in this residue of vacuum distillation was, however, destroyed by desiccating whole blood (by vacuum desiccation) and was not recovered by remoistening. Finally, ether-soluble extracts of blood were found not to contain the attractant or attractants.

In conclusion, it is stated that although carbon dioxide in blood, probably when transpired cutaneously, is certainly an important attractant to mosquitoes, some other substance or complex, so far not identified, is also of substantial importance, possibly more so than carbon dioxide. The discussion includes a valuable summary of results, positive and negative, of others on the chemical nature of the attractant or attractants in question. [See also this *Bulletin*, 1955, v. 52, 869.]

D. S. Bertram

TERZIAN, L. A. **Inhibition of Blood Digestion in Mosquitoes by Cations, and Cation-Antibiotic Mixtures.** [Correspondence.] *Nature*. 1958, Jan. 25, v. 181, 282–3.

Complete blood digestion by *Aëdes aegypti* was inhibited in up to 31% of mosquitoes allowed to feed, before and after a blood meal on normal chicks, on sugar solution containing calcium or magnesium cations (in their chloride salts). Chloride, as weak hydrochloric acid, had no discernible effect. This inhibitory effect was greatly enhanced for both cations by the addition of the antibiotic oxytetracycline. It would seem that this is the opposite of the usual interaction between cation and antibiotic, in which loss or inhibition of activity results. Eggs are produced in quantity in mosquitoes showing delayed digestion and are retained until darkly pigmented. Plasma digestion, which provides the nutrients for egg formation, appears therefore to be normal, but haemoglobin breakdown is retarded. Normally, the blood meal would be digested in 72 hours (at 26·5°C.) but in mosquitoes fed on these inhibiting solutions the meal has shrunk only to a third of its original size after 4 days and the benzidine test is positive for haem. Discrete blood cells are not, however, evident.

D. S. Bertram

PROVOST, M. W. **The Dispersal of** *Aedes taeniorhynchus*. **II. The Second Experiment.** *Mosquito News*. 1957, Dec., v. 17, No. 4, 233–47, 3 figs.

This work on dispersal of *Aëdes taeniorhynchus* is essentially a repetition of an earlier field experiment, but with some improvement in methods [see this *Bulletin*, 1953, v. 50, 252, for a good account of the first experiment]. About 1½ million adult *A. taeniorhynchus* emerged from breeding baths containing ^{32}P, mostly within a period of 3 hours, and dispersed about midnight onwards from the release point. This was on Sanibel Island, off the south-west coast of Florida, with adjacent islands and mainland at distances of 1¾ miles or more. Catches in light-traps, goat-baited traps, and "truck traps" (motor trucks supporting on top a large funnel-shaped trap, which collected mosquitoes as the truck travelled along a given length of route—about 4½ miles) were monitored with Geiger counters.

None of the traps captured much in the first 48 hours, but thereafter more substantial numbers of marked mosquitoes were taken in each trap. It is concluded that none of the traps (64 light, 8 baited, and 2 truck) sampled the initial dispersal of the mosquitoes but that they did so when this general migration was followed by purposive flights for feeding, oviposition, shelter and so on. A single rotary trap near the release point also functioned for about a month. Total captures from all traps over about a month were about 6½ million females, and of these 2,000 were radio-active (0·03%). Fewer normal and radio-active males were captured. Marked females were recovered up to 25 miles away and up to 24 days from release. All males were taken within 3 miles of the emergence point. Dispersal was generally down-wind. Flight over water exceeding about 2 miles in width was rare, the mosquitoes tending to concentrate on the land on the side towards the release point. Selective catching by the different kinds of trap was apparently happening, light traps trapping 4- or 5-day-old mosquitoes more than others, and the goat-traps indicating at least a first biting cycle fairly clearly.

D. S. Bertram

BRELAND, O. P. **Some Techniques for collecting Tree Hole Breeding Mosquitoes.** *Mosquito News*. 1957, Dec., v. 17, No. 4, 305–8.

The author, and colleagues, have done a good deal of collecting of mosquito larvae in tree-holes, intensified in recent years in connexion with surveys for *Haemogogus* in Texas [this *Bulletin*, 1956, v. 53, 1231]. A list is given of other species also obtained. There is no conclusive evidence of selection by mosquito species of particular species of tree; light may be more the nature of the stimulus inducing oviposition in tree-holes. There then follows an account of techniques for sampling tree-holes for larvae, emphasis being given to flooding holes to induce hatching of eggs (sometimes leaving them to "soak" for 24 to 48 hours)

and similar treatment in the laboratory of samples of the lining material of dry or damp tree-holes. *D. S. Bertram*

ROGERS, A. J., BEIDLER, E. J. & RATHBURN, C. B., Jr. **A Progress Report on Dosage Tests with Mosquito Adulticides.** *Mosquito News.* 1957, Sept., v. 17, No. 3, 190–94, 3 figs.

This paper presents a discussion of what is believed to be a new concept of dosage with aerosols applied under field conditions and a progress report on insecticide dosage tests with aerosols against adult saltmarsh mosquitoes in Florida.

A distinction is drawn between two methods of calculating dosages. In the conventional "deposit method", only applicable where the insecticide is distributed evenly as in the treatment of agricultural pests, the dose is calculated by dividing the weight of insecticide by the area covered. However, where aerosols are used, the alternative "space method" is suggested. This makes allowance both for the amount of insecticide that is deposited on the soil and also the amount that treats the air above it.

By means of the cage-test technique (*Mosquito News*, 1957, v. 17, 194) dosage tests with various insecticide aerosols were conducted against saltmarsh mosquitoes at Vero Beach, Florida. Malathion was found to be by far the most effective insecticide at the dosage levels used (0·13–0·54 lb./acre, calculated by the "space method"). The interpretation of the results for DDT was clouded by the resistance factor but it is thought that in the past there has been considerable overdosing with DDT in aerosol generators. Several insecticide mixtures were tried but only Lethane, in combination with malathion, gave satisfactory results. *R. J. Wood*

SHARMA, M. I. D., BAMI, H. L. & KRISHNAMURTHY, B. S. **Studies on the Rapid Loss of Biological Efficacy of D.D.T. and Dieldrin Suspensions on Mud Surfaces against Culicine Mosquitoes.** *Indian J. Malariology.* 1957, Sept., v. 11, No. 3, 309–19. [31 refs.]

When sprayed on to the walls of houses, insecticides quickly lose their toxicity, making culicine control doubly difficult. This problem was investigated in 4 villages of the Meerut District, Uttar Pradesh, during March and April 1957. 3 were sprayed with either 75% DDT (200 mgm./sq. ft.), 50% dieldrin (50 mgm./sq. ft.) or 50% dieldrin resin (50 mgm./sq. ft.) water dispersible powders while the fourth was left unsprayed as a control.

A slight decline in mosquito (principally *Culex fatigans*) density was noted for only one week after spraying. Similar results were obtained in the laboratory when *Culex fatigans* was exposed to these insecticides applied on mud panels.

Investigations on the composition, porosity and sorption capacity of the mud indicated that it was of a sorptive nature. This and relevant chemical and entomological data made it evident that inactivation of the insecticides was due to sorption.

This was supported by subsequent work which revealed that 90% of the insecticide particles were below 20 microns and about 75–80% below 10 microns [this *Bulletin*, 1953, v. 50, 165]. *R. J. Wood*

PHILLIPSON, J. **The Effect of Current Speed on the Distribution of the Larvae of the Blackflies, *Simulium variegatum* (Mg.) and *Simulium monticola* Fried. (Diptera).** *Bull. Entom. Res.* 1957, Dec., v. 48, Pt. 4, 811–19, 6 figs. [12 refs.]

This work was done in hill streams of the north of England, with additional observations in the laboratory. *Simulium variegatum* and *S. monticola* are common species of such streams. There are theoretical reasons for suggesting that flowing water cannot exceed a velocity of 6 metres per second and, indeed, even in rushing mountain streams velocities over 3 metres per second are rare. In the present work, velocities over this latter value were occasionally obtained and these were from waterfalls during heavy spates.

The results show that larvae of *S. variegatum* and *S. monticola* occur at velocities of 0·5 to 2·5 metres per second, but are most abundant in the narrower range of 1·0 to 2·0 metres per second. (Exceptionally, *S. variegatum* was found at 3·0 and 3·5 metres per second.) A table summarizes from the literature on British simuliids the velocity ranges and values tolerated and preferred by 8 species and varieties. This shows, for example, narrower velocity ranges acceptable to *S. venustum* and *S. ornatum* (respectively, 0·17–0·82 and 0·5–1·2 metres per second).

There is an interesting discussion relating these data to the characteristics of the type of streams usually populated by the different species. *S. venustum* and *S. ornatum* have a relatively narrow tolerance of low velocities and occur in streams of moderate speed with limited fluctuations in velocity. *S. variegatum* and *S. monticola* have wide and high tolerances and are typical of rapidly-flowing hill and mountain streams subject, moreover, to very sudden and considerable changes in the velocity of their flow. In conclusion, it is noted that, although other factors—selection of oviposition sites, food, substrate, etc.—are also concerned in creating the distribution pattern of simuliid species, current tolerance is certainly an important limiting factor to interspecific competition at the larval stage. It eliminates competition and replacement between species, or groups of species, with sharply defined and different tolerances of water flow.

Although larval identification is not impossible with British species, it was found desirable in this work to breed through samples of larvae to pupae for confident identification of species. *D. S. Bertram*

SHARMA, M. I. D., BHATIA, M. L., KRISHNAMURTHY, B. S. & SADANAND, A. V. **Studies on the Intergrading Forms of *Musca vicina*, Macquart and *M. nebulo*, Fabricius ♀♀.** [Research Notes.] *Bull. Nat. Soc. India for Malaria & other Mosquito-Borne Dis.* 1957, Sept., v. 5, No. 5, 244–5.

Only 80·4% of adult *Musca*, captured at Madanpur, Delhi State, could be identified to species. Most could be referred to *M. vicina* (55%); some to *M. nebulo* (25%); and a few showed the morphological characters of *M. sorbens* (0·4%). The rest showed characters intermediate between *M. vicina* and *M. nebulo*. Eggs of gravid females, which were morphologically referable to either *M. vicina* or *M. nebulo*, were reared to the fourth generation. The female offspring were variable in coloration, and some of the offspring of female *M. vicina* showed the coloration of *M. nebulo*, and *vice versa*. Eggs obtained from females of the fourth generation, which were referable to either *M. vicina* or *M. nebulo*, developed into adults which again showed variation in the body coloration of the females. "The male progeny of both the species showed almost identical characters", and the authors suggest that *M. vicina* and *M. nebulo* are not distinct species [see this *Bulletin*, 1957, v. 54, 502].

B. R. Laurence

CHEFURKA, W. **Oxidative Metabolism of Carbohydrates in Insects. III. Hexose Monophosphate Oxidative Cycle in the Housefly, *Musca domestica* L.** *Canadian J. Biochem. & Physiol.* 1958, Jan., v. 36, No. 1, 83–102, 10 figs. [55 refs.]

See this *Bulletin*, 1955, v. 52, (696).

FRONTALI, N. **Acetylcholine Synthesis in the Housefly Head.** *J. Insect Physiol.* London. 1958, Jan., v. 1, No. 4, 319–26, 4 figs. [25 refs.]

BARKER, R. J. **The Absorption and Degradation of DDT at Varied Dosages by the House Fly.** *J. Econom. Entom.* 1957, Dec., v. 50, No. 6, 748–50, 1 fig. [17 refs.]

"Increased dosages at constant volume give increased absorption in surviving flies. However, at larger dosages the increases in absorption are proportionally less.

"The amount of degraded DDT increases with higher dosages. Degradation varies from 84 to 99% of the absorbed DDT, but shows no trend dependent upon dosage. The survivors of several resistant strains give only indistinguishable differences in absorption."

[See this *Bulletin*, 1957, v. 54, 764, 1372; 1958, v. 55, 110.]

CHURA-BURA, B. L. Emploi des isotopes radioactifs dans l'étude du rôle épidémiologique des mouches. [**Use of Radioactive Isotopes in the Study of the Epidemiological Role of Flies**] *J. Hyg., Epidemiol., Microbiol. & Immunol.* Prague. 1957, v. 1, No. 3, 249–55, 1 plan. [15 refs.]

This paper records the results of some experiments on the dispersion of flies from cesspools and privy pits into houses. A solution of radio-active $Na_2H\ PO_4$ was spread over 1/10 of the surface of a cesspool and 7 hours later 588 flies were captured in surrounding houses, of which 5 contained the isotope. The flight of the flies from privy pits 3 km. from a town was studied by covering 1/6 of the surface with a solution of phosphorus isotope and catching flies in the town. 67,000 flies were captured, 248 of which were isotope-labelled. The greatest prevalence of flies was within a radius of 1 km. but at 1 to 3 km. labelled flies formed 0·18 to 0·16% of those captured and at 3 to 5 km., 0·1 to 0·06%. Within 24 hours flies had spread to a distance of 2·8 km. and at 72 hours up to 5 km. In another experiment 1,619 labelled flies were taken in a total of 133,000. The maximum distances travelled were: domestic flies, 3·8 km.; *Protophormia terraenovae*, 5·6 km.; *Muscina stabulans*, 2·1 km.; *Lucilia caesar*, 4·6 km. Dispersion was towards the most densely inhabited part of the town, and was effected by flight and carriage by motor transport. Flight was at the rate of 1 km. per hour. The maximum distance covered was 10·7 km. for domestic flies, 15 km. for *Muscina stabulans* and *Hydrotaea dentipes* and 4 to 8 km. for other species.

The fate of dysentery organisms in the intestines of flies was studied by feeding them on cultures grown on radio-active agar. Immediately after feeding 98% of the radio-activity was in the flies' intestines but at 24 hours 40% to 70% was in the tissues and on the feet.

[For other studies on dispersion of labelled flies see this *Bulletin*, 1955, v. 52, 101, 301, 411.] *T. H. Davey*

i. GRATWICK, M. **The Uptake of DDT and other Lipophilic Particles by Blowflies walking over Deposits.** *Bull. Entom. Res.* 1957, Dec., v. 48, Pt. 4, 733–40, 2 figs.

ii. ————. **The Contamination of Insects of Different Species exposed to Dust Deposits.** *Ibid.*, 741–53, 4 figs.

i. The action of residual insecticides usually depends on insects walking over the deposits and picking up a lethal dose. The author has been investigating various aspects of rate of contamination of insects, mainly using the blowfly *Phormia terraenovae*. She found that dry particles of DDT were picked up by the flies very much in the same way as particles of dye (which are easier to assay colorimetrically). The rates of pick-up of both substances were reduced if the surface treated was covered with

a thin film of oil. DDT was affected much more than the dye, this being, apparently, due to the long thin shape of the DDT crystals (increasing area of adhesion) and not to its greater solubility. It is thus evident that the greater toxicity to insects of a film of crystals wet with oil spray is not due to greater pick-up; it must be due to the contamination of DDT dissolved in the oil.

Various other aspects of contamination of insects by particles are discussed, particularly in relation to the nature of the substrate.

ii. This paper deals with rates of contamination by particles of dye, of different kinds of insect walking over dusted surfaces. Five very different kinds of insect were chosen: wasp workers, ground beetles, soldier beetles, cotton stainer bugs and plant bugs. The average weights ranged from 6 to 147 mgm. and the different species varied considerably in hairiness.

Measurements of the amounts of dye particles picked up by these different insects showed that the uptake per step varied only slightly (range: 1 to 1·7 μgm. per step). Since there were big differences in weight, it is evident that the smaller insects picked up a bigger " dose ", per unit body weight, than the larger ones.

The ratios of quantities acquired by the different legs were roughly similar for all the insects, the hind legs generally picking up as much as the first two pairs together. *J. R. Busvine*

Lewis, C. T. & Hughes, J. C. **Studies concerning the Uptake of Contact Insecticides. II.—The Contamination of Flies exposed to Particulate Deposits.** *Bull. Entom. Res.* 1957, Dec., v. 48, Pt. 4, 755–68, 6 figs. [19 refs.]

The uptake of small particles by the feet of blowflies (*Phormia terraenovae*) was studied by making them walk over dusted surfaces in a shallow Perspex box or by lowering them onto such surfaces. By the use of the rapidly asphyxiating gas CO_2, very short contacts could be made before the (stupefied) flies were removed. The particles were mainly pure dyes; one, being oil-soluble and water-insoluble, simulated the residual insecticides, while another with the opposite properties represented diluent dust. A dusting tower was used to give uniform particles of 20 ± 3 microns. The pick-up by flies was measured by soaking them in solvent and measuring the dye colorimetrically.

It was found that flies picked up most at their first contact and added progressively less with each subsequent step. A microscopic examination revealed that the particles were collected by adhesion, mainly with primary and secondary setae. The mid-tarsal segments were the most efficient collectors. On being contaminated, the flies continually made " cleaning " movements, which in fact distributed the particles all over the body in a constant pattern. On removal to a clean environment, flies tended to lose particles, mainly by a reversal of the process of contamination (*i.e.*, the cleaning movements equalized the loss from the tarsi to

the clean surface). However, the rate of loss was relatively slow: thus 10 μgm. of particles would be picked up in 2–3 seconds and much of this would persist after 2 hours' cleaning.

Dry particles of the lipophilic dust were picked up much more quickly than the lipophobic one, from an indifferent surface; but this difference was small from a hard vegetable wax surface and apparently reversed on a soft (beeswax) surface. The presence of oil on a substrate greatly reduced the rate of pick-up of lipophilic particles. *J. R. Busvine*

CHAMS, G. & MOHSÉNINE, H. Un cas de myase ophthalmique par la larve de *Rhinostrus purpureus*. [**Conjunctival Myiasis due to** *Rhinostrus purpureus*] *Acta Med. Iranica.* 1956, v. 1, No. 1, 22–6, 2 coloured figs. on pl. & 2 text figs.

The English summary appended to the paper is as follows:—

"This is an exceptionally rare disease in Iran. We found one case due to 'Rhinostrus Purpureus', which after removal of the larvae cleared completely, and the eye became normal."

TOBIE, J. E., EDGCOMB, J. H. & FREIREICH, E. J. **Tongue Worm** (*Linguatula serrata*) **Infestation in a Patient with Acute Leukemia.** *Amer. J. Clin. Path.* 1957, Dec., v. 28, No. 6, 628–33, 3 figs.

"Infestation with the nymphal stage of *Linguatula serrata* was observed in a 4-year-old boy who had acute leukemia. The parasite was first detected in a histologic section, and entire linguatulids were subsequently dissected from a mesenteric lymph node included with specimens removed at necropsy. It is possible that the patient contracted this infestation during residence in the United States. A survey of the literature failed to reveal an instance of human infestation in the United States by the nymph of this arthropod parasite."

AUDY, J. R. **Malaysian Parasites—XXXIV. A Review of the Literature.** *Studies from Inst. Med. Res. Federation of Malaya.* 1957, No. 28, 427–47.

A full review of these studies will appear in the July issue of the *Tropical Diseases Bulletin.*

PRÍVORA, M. & SAMŠINÁK, K. Milben als Menschenplage. [**Mites as Pests of Man**] *Ztschr. f. Parasitenk.* 1958, v. 18, No. 3, 257–69, 6 figs. [Numerous refs.]

There have been, in recent years, instances in Czechoslovakia of mites being a considerable pest to human beings, the species concerned being *Grosschaftella pontiger*, *Ornithonyssus bacoti*, *O. natricis*, *Cheyletus aversor* and *Tyrophagus noxius*.

G. pontiger caused cutaneous reactions in a child and its mother. This was associated with the mites occurring in the structure of their bed. There is a considerable discussion of the synonymy of this mite—formerly *Eulaelaps pontiger* or *Haemogamasus oudemansi*—leading to the erection of the new genus, *Grosschaftella* in this paper. Several cases of urticarial reactions due to *O. bacoti* are reported from different places. It is considered to be generally distributed in the country as a parasite of domestic rats. *O. natricis*, a snake parasite, caused similar reactions in persons working with snakes in a laboratory making snake venene. Their immediate reactions suggested an allergic state. *T. noxius*, not previously recorded from central Europe, was a pest on wax moth cultures, etc., in certain scientific research institutes. It also occurred in masses on the furniture and walls of dwellings, but caused no ill-effects even on children. It appeared to have been introduced in these cases on a particular kind of insulating material (" Sopalit ") used in the construction of the floors of the rooms. This mite is closely related to but accepted as distinct from *T. castellanii*, which is generally associated with dermatitis. Sopalit is made of magnesium mortar mixed with sunflower seed husk. *Cheyletus aversor* was also commonly associated with this insulation material and, unlike *T. noxius*, caused severe dermatitis. Treatment of the infested rooms with gamma BHC was only partially effective. There are photographs or line figures of the mites.

D. S. Bertram

DUNCAN, S. *Dermanyssus gallinae* **(DeGeer, 1778) attacking Man.** [Research Notes.] *J. Parasitology.* 1957, Dec., v. 43, No. 6, 637.

Two adults and a child aged 14 months at Danvers, Mass., were bitten frequently over a period of 2 weeks by mites identified as the chicken mite, *Dermanyssus gallinae*. The mites first appeared when pigeons were nesting under the eaves of the house, and later the mites were found distributed in the house, especially in the bathroom, where they clustered in cracks and behind mirrors.

Bites were most numerous on the limbs and around the waist. They took the form of red patches and were accompanied by pruritus. The adults felt no pain. The redness and pruritus at each site disappeared in 1 to 2 days. Widespread use of 5% DDT and elimination of the pigeons resulted in eradication of the mites in a few days. It is suggested that the presence of an excessive number of mites in the pigeon nests may have been a factor in the invasion of the house.

H. J. O'D. Burke-Gaffney

AUDY, J. R. & DOMROW, R. **Malaysian Parasites—XXIII. A Revision of Oriental and Australasian Species of** *Euschongastia* **Ewing, including** *Walchiella* **Fuller, and Description of a New Subgenus,** *Derrickiella* **(Acarina, Trombiculidae).** *Studies from Inst. Med. Res. Federation of Malaya.* 1957, No. 28, 121–52, 37 figs. [31 refs.]

See also p. 503, MILES & KINNEY, **An Apparatus for Rapid Collection of Fleas from Rodent Nests.**

WEIDHAAS, D. E. **Laboratory Study of the Release of some Organic Phosphorus Insecticides into Water from Granular Formulations.** *Mosquito News.* 1957, Sept., v. 17, No. 3, 168–72.

A study has been made on the release into water of parathion, chlorthion and EPN from 5 types of carrier. Water samples were analysed after treatment and the behaviour of each formulation noted.

When water treated with attapulgite granules containing 1% parathion was sampled after 24 hours the toxicant was uniformly distributed between the top and ¼ inch from the bottom. When the quantity of granules dissolved in a given volume of water was increased, the concentration of toxicant in the water was also raised but not in proportion to the weight of granules dissolved; there was a progressive decrease in the percentage of the total toxicant released.

Granules containing 1% parathion showed a faster release than those containing 10% except when montmorillonite was the carrier. These differences were reduced with passage of time. Both concentrations on montmorillonite were released at approximately the same rate but this was lower than other 1% formulations. Parathion was released slightly less rapidly into salt water than into distilled water from all formulations except the 10% concentration of montmorillonite. This showed a considerable decrease in the amount released in a given time.

Tests were run to study the effect of including solvents and wetting agents in the formulations. While the addition of 2% kerosene or Triton X-100 showed no effect on the amount liberated, 25% of Velsicol AR-60 decreased the rate of release. The release rate of parathion and chlorthion was about the same, while that of EPN was much lower.

R. J. Wood

BROWN, A. W. A., TAKEI, S. & NAGASAWA, S. [Edited by.] **Japanese Contributions to the Study of the Insecticide-Resistance Problem.** pp. iv + 244, numerous figs. 1957, Oct. Kyoto: Institute of Insect Control, Kyoto University, Japan; published for the World Health Organization.

In 1956 the World Health Organization technical staff, being impressed by the serious problem of insecticide resistance, wanted to find out how much research on the subject was in progress in different countries. This was determined partly by correspondence; but more useful information was obtained by employing consultants to travel about, visiting research centres and discussing the matter with various experts. The consultant who visited Western Pacific centres was Dr. M. H. GOODWIN; in his visit to Japan, he was impressed by the considerable body of research on

insecticides and resistance, which was virtually overlooked by Western scientists because it was published in Japanese. The authors were generally able to read European languages but naturally could not produce more than a brief summary in these languages, usually in English. Following Dr. Goodwin's recommendation, Dr. A. W. A. Brown was sent from WHO headquarters to Japan, where in cooperation with Japanese scientists he collated 36 translations of papers dealing with insecticidal action or on resistance, which have now been published.

Papers 1 to 4 by K. Yasutomi of National Institute of Health, Tokio, deal with resistant strains of body lice in Japan. Nos. 5 to 13, mainly by M. Tsukamoto and M. Ogaki of Genetical Laboratory, Osaka University, deal with genetical experiments on resistant strains of *Drosophila melanogaster*.

The next series of papers (Nos. 14 to 21) concern various factors influencing insecticidal action in normal insects (age, sex, size, density of rearing, etc.). These are by various authors at the Institute of Chemical Research, Kyoto University, the Departments of Agriculture and Parasitology of Tokio University, and the National Institute of Agricultural Science, Tokio.

The last series of papers are on physiology and toxicology by workers at the University and the Institute of Agriculture, Tokio. Nos. 22 to 28, by T. Yamusaki and Ishii, T., mainly concern electro-encephalogram measurements of action potentials in the insect nervous system and the effects of insecticides on them. Nos. 29 to 36 deal with investigations of insecticidal poisoning on insect enzyme systems, by J. Fukami and C. Tomizawa.

It is impossible, here, to review the results of all these papers. No one would claim that they contain epoch-making discoveries; but the technical levels are generally very high and many Western research workers will benefit from this very useful additional body of data made available to them. *J. R. Busvine*

See also p. 601, Colonial Office. **Colonial Research 1956–1957. Colonial Pesticides Research Committee. Tenth Annual Report (1956–1957).**

MISCELLANEOUS PAPERS

Luder, J. **Some Paediatric Problems of Uganda.** *Brit. Med. J.* 1957, Nov. 16, 1143–8, 6 figs. [13 refs.]

The author points out that "The whole subject of tropical paediatrics has been largely neglected in medical practice and teaching in these ["the underdeveloped"] regions and even more so in the advanced countries".

This is an excellent article and should be read in full. It contains

sections on the background, the medical services, problems of diagnosis and treatment, the neonates, infant feeding, malnutrition, malaria, helminths, specific fevers, other infections and on geographical paediatrics.

Dr. Luder concludes his summary: "A study of the differential geographical distribution of disease will undoubtedly throw much light upon aetiology, and is worthy of greater effort." [But these questions are not so much concerned with geography as with accurate diagnosis and management of patients together with studies of attitudes, traditions, habits and resources. The urgent need is for long-term follow-up of child health in the various communities.] *Cicely D. Williams*

ARCHER, T. C. R. **Medical Problems of the Operational Infantry Soldier in Malaya.** *J. Roy. Army Med. Corps.* 1958, Jan., v. 104, No. 1, 1–13.

The author, as medical personnel research officer, has made a detailed personal investigation of the activities, living conditions and health of British infantrymen engaged in jungle operations in Malaya. The terrain is hilly, and is covered by thick jungle which forms a dense canopy through which sunlight cannot penetrate. Though temperatures are moderate, varying from 90°F. at noon to 70° at night, the relative humidity is always high, often 90° or more. Under these adverse conditions patrols operate as self-contained units, carrying all supplies for a 5-day period, after which they are revictualled for a further 5-day period by air-drop from helicopters. Clothing is saturated with sweat and with water from the numerous streams which have to be forded, but a dry outfit is carried which is donned after washing in the evening, as night attire. It is the usual practice to sleep on the ground under a bivouac.

It can scarcely cause surprise that under these conditions skin infections are almost universal and, in their severe forms, constitute the highest single cause for hospital admission, with an incidence of 46 per 1,000 per annum. Fungal infections of feet and groins appear regularly after about 3 months' service in the jungle, and, if untreated, may become generalized. Most respond to such simple fungicides as Castellani's paint or Whitfield's ointment, but a resistant minority of some 5% may require hospital treatment. Cuts, insect bites, scratches and abrasions frequently "become septic", while furunculosis, bullous impetigo and prickly heat are common. The grey woollen army sock, which cannot be boiled, is clearly an unsuitable footwear in such conditions where fungal infections are rife. Prophylaxis centres round daily washing in a stream, and the use of foot and body powder. Malaria no longer holds any dangers and "paludrine [proguanil] resistance" when reported proves to be due to irregular taking of the prophylactic. Intestinal infections are rare, since the soldier is operating in clear, virgin country where the streams are uncontaminated. Each man carries an individual water-sterilization outfit, comprising tablets of Halozone

with a detasting tablet, but these are not always used. Leptospirosis, however, proves a serious hazard, and in 1954 caused 150 cases with 2 deaths. It was usually acquired during operations in cultivated, muddy, swampy areas. Scrub typhus continues to provide a considerable morbidity, amounting to some 120 cases annually. Mite-repellent drill may become lax and, in sweat- and water-saturated clothing, the repellent chemical is quickly lost. Chloramphenicol has, however, banished the danger of this disease. Heat exhaustion may occur under exceptional conditions of exertion, especially during the early training period, before the new arrival has adjusted himself to a tropical climate.

The provision of the most suitable ration is a difficult problem: for a day's supply constitutes a 4 lb. burden for each man. Dehydrated foods, though light, are so far inadequate nutritionally, and unpalatable. The soldier's taste undergoes unexpected variation, and rice, curry powder for addition to tinned stews, and tea with sugar and milk are preferred to potatoes, biscuits, puddings and cold fruit drinks.

Leeches, ants, hornets and house-flies contribute their quota of discomfort, but scorpions and snakes provide a negligible hazard. Wild buffalo and elephant are dangerous and have caused fatalities.

The following problems call for solution: the provision of socks which can be sterilized, and of an anti-fungal prophylactic with which they can be impregnated; prophylactic and therapeutic agents for leptospirosis; a better water-sterilizing kit; a larger and more comfortable haversack; a lighter packed daily ration.

[This is a most interesting and thoughtful communication which will repay those who read it in full.] *J. H. Walters*

REPORTS AND SURVEYS

Colonial Office. **Colonial Research 1956–1957. Colonial Pesticides Research Committee. Tenth Annual Report (1956–1957)** [Hall, W. J., Chairman] (pp. 197–218). Cmnd. 321. 322 pp. 1957, Nov. London: H.M. Stationery Office. [11s.]

The report of the Committee includes some sections only of agricultural interest, besides synopsis of the research in progress by the Colonial Insecticides Research Unit at Porton, the Colonial Pesticides Research Unit in East Africa, Imperial College Field Station at Silwood Park, Rothamsted Experimental Station, the Biting Fly Research Unit in Uganda, the Filariasis Research in Fiji, and the Western Sokoto Malaria Control Pilot Project in Nigeria. A separate part of the report indicates the nature of some of the more important research going on in the colonies under auspices other than that of the Committee. Much of this is agricultural. The report may be consulted in the original by those

interested for brief indications of the trend of work in the various units. Those desiring more detail would certainly need to see the annual reports of the individual units in question or consult published papers. There is a considerable list of references, many of them, however, in the form of miscellaneous reports circulated to the Committee.

At Porton, investigations are concerned with susceptibility of mosquito larvae to insecticides, surface and soil sorption of insecticides, organophosphorus insecticides, and aerial spraying technique. Other United Kingdom units deal with olfaction in insects and various aspects of the efficiency of insecticide deposits.

In East Africa, the Biting Fly Research Unit continues to keep *Stomoxys calcitrans* as a laboratory strain and is also studying breeding in the field. There is yet no evidence that *S. calcitrans* transmits *Trypanosoma congolense* mechanically, and suspicions are directed to tabanids. There are brief accounts of tsetse control and mosquito control by the Pesticides Research Unit in East Africa. At Taveta malaria indices are low, despite considerable outdoor resting of *A. gambiae*. No resistance has occurred, though this is already well established in Western Sokoto (but not in a former pilot control scheme at Ilaro in Nigeria) where resistance is to dieldrin and gamma BHC with cross-resistance between these but not with DDT: nor is there resistance in Zanzibar, or Tanga. At Dar-es-Salaam, frequent aerial distribution of dieldrin granules at 1 lb. per acre to extensive breeding waters reduced apparent breeding but adult catches in houses were still appreciable. Non-sorptive formulations of insecticides are to be submitted to field trials. In Fiji, work is on the efficacy of residual sprayings, flight-range of filarial vectors, and non-human filarioids. Levels of susceptibility to insecticides of local vectors are being assessed by accepted standardized methods. There is some " natural resistance " to DDT in *Aëdes pseudoscutellaris*. A brief description of a new way of sampling surface deposits of insecticides comes from the Western Sokoto Project, where also effects of humidity on surface deposits of insecticide are to be investigated on local muds. In Trinidad, laboratory researches are on insecticide susceptibilities of *Aëdes aegypti* in the larval stage. In Uganda, 5–8 gallons per mile of 5% dieldrin applied by simple mechanical sprayer to riverine vegetation remained fully effective against *Glossina palpalis* for 90 days. In Northern Rhodesia, control of *G. morsitans* by gamma BHC has been substantial in two areas treated, with some re-treatment necessary to give what is hoped will be eradication. Work goes on in several colonies on herbicides and arboricides. *D. S. Bertram*

COLONIAL OFFICE. **Colonial Research 1956–1957. Tsetse Fly and Trypanosomiasis Committee. Report for 1956–1957** [MONSON, W. B. L., Chairman] (pp. 287–302). Cmnd. 321. 322 pp. 1957, Nov. London: H.M. Stationery Office. [11s.]

This publication embodies brief digests of the annual reports and publications of the East African Trypanosomiasis Research Organization, the West African Institute for Trypanosomiasis Research, and includes a section on the work against tsetse and trypanosomiasis by territorial departments.

Of note in East African research are studies on water control in the *Glossina* pupa, the role of warthog and hippopotamus as food for game tsetse, game tsetse resting-places by day and night in reference to economical and efficient insecticide applications, and the availability of tsetse. In this connexion, *G. morsitans* in Uganda is elusive and, as in the case of *G. pallidipes*, can maintain cattle trypanosomiasis though seemingly very scarce. There are indications that *G. pallidipes* individuals, once having bitten man, are prone subsequently to select man for food. This may be significant in its role as vector of *Trypanosoma rhodesiense* on the north-east shore of Lake Victoria. A small hospital is now available at Sukulu which facilitates proper study of trypanosome strains. Veterinary work is much concerned with drug trials. Pre-treatment of cattle with antrycide pro-salt gives some months of protection against *T. congolense* infection. With drugs for human trypanosomiasis, tests with fly-passaged *T. rhodesiense* are less favourable than results with needle-passage, the method of assay by manufacturers.

In West Africa the Institute is much concerned with the chemoprophylaxis and chemotherapy of veterinary trypanosomiasis. Insoluble suramin complexes of trypanocidal drugs, developed at the Institute, are promising prophylactically. Cattle are the test animals and challenge is with *palpalis*-transmitted *T. vivax*. Thus, combination of suramin with ethidium bromide gave 7 months' and 13 months' protection at, respectively, 5 and 10 mgm. per kgm. at one injection. (It costs only 5s. 9d. for the ingredients at the higher dosage.) General side-effects are not apparent, but severe local reaction at the injection site is being looked into. Various field assays are in progress. There is some similar work also in progress with *T. congolense* in cattle and *T. simiae* in pigs.

As regards human trypanosomiasis: characteristics of strains of *T. gambiense* are being worked out, and biochemical studies on *T. rhodesiense* are in progress. There is a brief account of biochemical analysis of tsetse saliva and its possible value in indicating the essentials, as in the tsetse glands, for the culturing of trypanosomes *in vitro*: this might illuminate the synthesis of trypanocidal drugs on a logical basis. Malarsen is now proved to be an alternative treatment for *T. gambiense* infections under field conditions. Berenil is apparently effective in early cases. Stylomycin was, on manufacturer's request, withdrawn from trial.

In tsetse research, *G. palpalis* is a flourishing colony; important in terms of the use of irradiated, released, males for tsetse control is the fact that *G. palpalis* females will mate more than once. This is unfavourable to this method of tsetse control. Forest tsetse are being

studied carefully as several species are infected with bovine trypanosomiasis. Six species and their infection rates (from 2 to 27% positive) are listed. Blood-meal tests reveal that for *G. morsitans* in Nigeria warthog is an important host. Obstructive clearing is successful against *G. palpalis*, provided isolation is possible. Wash-out of felled trees, etc., by spates also resulted in a failure of this method: this was in quite hilly country.

There is a considerable synopsis of the work of territorial departments, too condensed to justify more than an indication of the works in hand. Much attention is given to cattle trypanosomiasis, especially to the use of antrycide pro-salt, Ethidium-Surinam, Prothidium, and Berenil, besides others. Prothidium in Nigeria gave severe local reaction and much delayed mortality but, in Kenya, this was an outstandingly successful drug without this mortality, although local reactions did occur in certain instances. There are indications of work by various approaches on tsetse control (insecticides, clearing, arboricides) and laboratory studies of trypanosome strains. In Kenya much land has become usable by man and his cattle by a judicious use of bush clearing, insecticides, prophylactic and curative drugs or combinations of these. *G. longipennis* is now being studied in the field more than formerly. *D. S. Bertram*

UGANDA PROTECTORATE. **Annual Report of the Tsetse Control Department for the Year ended 31st December, 1956** [ROBERTSON, A. G., Director]. 43 pp., 6 folding maps (1 coloured). 1957. Entebbe: Govt. Printer, P.O. Box 33, Uganda. [Shs. 2/75.]

The main objectives of the Tsetse Control Department, which was founded in 1947, are the reclamation of tsetse-occupied territory in north and central Uganda and the establishment of human settlements and cultivation.

The tsetse flies concerned are *Glossina morsitans*, *G. pallidipes*, with *G. fuscipleuris* and *G. brevipalpis* in some places and *G. palpalis* along watercourses.

The country may roughly be divided into 2 zones; seven-tenths in the south-east which are "predominantly fly-free" and three-tenths in the north-west "predominantly tsetse-infested".

In general the report for 1956 is, in spite of some setbacks, a story of success told in detail by a number of field officers working in 13 areas. Their accounts are illustrated by maps of the areas and a map of the whole country showing the distribution of the tsetse flies and the situation of the "consolidation lines".

A selection of the main achievements during 1956 includes the following: the areas to be cleared of tsetse have been considerably reduced in size; in many places the catches of tsetse have declined; hundreds of families have been settled in several areas and cattle are thriving (for example, in Buganda Province there are now more than 500,000 cattle).

G. palpalis has been eliminated from water-side vegetation at a danger spot in Bukedi district by a single application of 5% dieldrin from a dinghy-borne power-operated spraying machine; in South Busoga, from whence people had to be evacuated in early 1940 because of a sleeping sickness epidemic, resettlement along the old road has begun and is being carefully planned and observed; the results so far are encouraging though the danger still exists because *G. pallidipes* is nearby.

Some of the survey methods employed during the year were the use of bait cattle, vehicle fly-pickets, vegetation studies, aerial photography and Mr. WEITZ's perfected techniques of blood-meal identifications which proved the case against the hippopotamus.

Control methods operated included the discriminative clearing of vegetation, late burning, the construction of footpaths and motorways, undercutting along river banks, the use of trypanocidal drugs and insecticides, the hunting of buck, buffalo, bushpig, elephant and hippopotamus. In one area an organized tribal pig-hunt of inland thickets was arranged to start in 1957 in an attempt to reduce the food supply of *G. brevipalpis* and therefore the area which had to be sprayed with insecticide.

Finally, the formation of consolidation lines of human settlement and activity has converted game-infested tsetse bush into game-free cultivated land. *H. S. Leeson*

SEAL, S. C. [M.B.B.S., Ph.D., D.P.H., F.A.P.H.A., F.N.I.] & BHATTACHARJI, L. M. [M.B.B.S., D.P.H., D.T.M.]. **Report on a Rapid Medical and General Health Survey of the Sikkim State.** pp. iii + 155, 34 figs. & 1 map on 20 pls. (1 folding). 1954, Mar. 31. Calcutta–12: All India Institute of Hygiene & Public Health. Delhi: Manager of Publications, Civil Lines, India.

The main purpose of this rapid survey, carried out by the All India Institute of Hygiene and Public Health, was to obtain an integrated picture of the health and sickness of the communities in Sikkim state, their immunity and nutritional status, and their socio-economic, housing and environmental conditions. The state was divided into 5 zones, all of which were studied. Survey procedure consisted of (1) recording the medical, personal and socio-economic histories of individuals, families and villages during the previous year; (2) physical examination comprising anthropometry and nutritional assessment; (3) examination of blood, stool, sputum and other discharges; and collection of possible insect vectors; (4) tuberculin test with PPD. Schedules of the enquiries made are recorded in an appendix.

Sikkim lies between Tibet, Darjeeling, Bhutan and Nepal, and covers an area of 2,818 square miles. There are 137,725 inhabitants at an average density of 50 per square mile. The population is almost wholly rural with only one large town. The altitude ranges from 1,000 feet to over 12,000 feet, and the climate varies correspondingly from warm and

humid to cold and severe. The annual rainfall is heavy, varying from 64 to 170 inches. Communications are poor. The houses are dark, ill-ventilated and insanitary, occupied by the family and its domestic stock, and few possess latrines. Water is drawn from springs or rivers. The state is inhabited by 5 main racial groups (Nepalis, Sikkimese, Lepchas, Tibetans and Marwaris) who are almost exclusively Hindu (72%) or Buddhist (29%).

The total number of persons examined was 1,700, representing some 6% of the population of the villages surveyed. Of these 68% were Nepalese, 11·4% Sikkimese, and only 10% Lepchas who were the original inhabitants. Maize was the main staple food, but rice also was popular. Millets and buckwheat were grown to make a fermented drink which was a universal beverage. Meat was included in the diet of some 77% of those surveyed and milk was drunk by 38%.

The medical budget amounted to nearly Rs.98,000, of which Rs.73,000 was spent on medical relief and Rs.25,000 on public health. There were 3 hospitals, containing respectively 60, 16 and 4 beds, a dispensary with 3 emergency beds and 6 other dispensaries, of which 3 were provided by the state and 3 by Missions. At these dispensaries only symptomatic treatment for the common ailments was given. There were also 2 mobile dispensaries which were employed in areas of epidemic outbreaks. There were no facilities for isolation of cases of infectious disease; fortunately no major epidemics have occurred in recent years. There were only 5 qualified doctors in the state, no qualified public health staff, and only 6 qualified nurses. There was no midwifery or child welfare work. Sweepers were responsible for the environmental sanitation of the towns and large villages.

An assessment of wealth indicated that 17·8% of the families were rich, 27·8% moderately well off, 37·3% were poor and 17·0% very poor. Immigrant traders formed 80% of the rich, and of the indigenous population 59% were poor. Of 1,673 persons medically examined 15% showed some degree of incapacity due to defective health; 1·5% were acutely ill and 4·4% chronically ill. The principal diseases in order of prevalence were hookworm, skin diseases, malaria, kala azar, tuberculosis, tapeworm, venereal diseases, roundworm, miscellaneous fevers, epilepsy and other nervous complaints, throat infections and tropical ulcer. Examination of those not clinically ill revealed lesions in more than 20% consisting of dental defects, goitre, infections of tonsils and adenoids, and pediculosis. A history of illness during the previous year was obtained from 31·5%, attributable to malaria and other fevers, whooping cough, respiratory disease and kala azar. Returns from hospitals and dispensaries showed that attendances for the more serious conditions fell far short of the incidence revealed at the survey, probably owing to acuteness of the disease, distance from medical facilities, difficulty of communications and reliance on folk medicine.

The principal diseases are considered individually and many interesting

findings reported. For example, nearly half of the clinical tuberculosis (incidence 138 per 10,000) was non-pulmonary, and though syphilis and gonorrhoea were prevalent they occurred only in the Nepalese and Sikkimese and were mainly urban diseases. Helminth infection was heavy and widespread, and the opinion was formed that it caused much incapacity and should receive high priority in control programmes. Haemoglobin values were low in areas where malaria, kala azar and helminths were prevalent, and they improved with increasing altitude. Nearly half those examined were in a good nutritional state, the Tibetans showing the best condition and the Nepalese the worst. Ariboflavinosis was the only common vitamin deficiency. Smallpox vaccination had been performed on 88% of the people investigated.

No vital statistics had been collected but data covering the previous year gave a crude birth rate of 28·8 per 1,000, an abortion rate of 9·1%, and a still-birth rate of 3·6%. The birth rate was highest among the Sikkimese (52·6%) and lowest among the Lepchas and Tibetans. The sex ratio of males to females was 1:1·5 at birth. The crude death rate was 15·9 per 1,000 and the infant mortality rate 208.

This rapid survey collected a remarkable amount of information which is tabulated in 54 tables and 9 appendices. A series of photographs illustrates the environment. The results are of particular interest because of the different racial communities, with different habits, comprising the population, and the association of disease with different altitudes. It gives an excellent picture of the state of health of a people with little contact with civilization among whom medical facilities are scanty, and reveals a surprisingly low incidence of serious illness. *T. H. Davey*

Gonzalo del Río, A. La labor sanitaria en la amazonia peruana. [**Health Organization in the Peruvian Amazonia**] *Med. Trop.* Madrid. 1957, Nov., v. 30, No. 5, 353–80, 2 maps & 5 figs.

This is a general account of sanitary organization in a small area of Peruvian Amazonia. It is a section of the Department of the Province of Madre de Dios in a zone of 150 km. by 60 km., including the capital, Maldonado, in the angle between the frontiers of Brazil and Bolivia, and it contains the headwaters of the rivers Piedras and Madre de Dios. It has a population of 8,000–10,000. The paper embraces brief descriptions of educational measures, school hygiene, dental services, in addition to a survey of helminthic parasites, tropical ulcer, leishmaniasis and pinta. There are also details about an anti-trachoma campaign and the organization of a vaccine service. The findings are set out in numerous tables.

Philip Manson-Bahr

BOOK REVIEWS

BUSVINE, J. R. [Ph.D., D.Sc.] **A Critical Review of the Techniques for Testing Insecticides.** pp. ix + 208, 50 figs. 1957. London: Commonwealth Institute of Entomology, 56, Queen's Gate, S.W.7. [30s.]

In this comprehensive review of techniques for testing insecticides, emphasis is laid on the need for simplicity and standardization. In no other field have these two principles shown their usefulness more than in the establishment of cases of resistance in mosquitoes. Thanks to the simplest of techniques largely designed by the author of this book himself and adopted by the World Health Organization, the basic susceptibilities of most of the malaria vectors of the world have now been established and show a remarkable consistency. The same technique applied to resistant anophelines, where these have appeared, has similarly produced consistent results, so much so that now discriminating dosages separating resistant and susceptible strains and even sometimes hybrids can be predicted with considerable reliance for the three insecticides DDT, BHC and dieldrin.

The first part of the book concerns the principle of standardization. Starting with a consideration of the handling methods of the insects used for testing, the author goes on to discuss what he calls the intrinsic and extrinsic factors affecting the insects. Intrinsic factors include species, stage, age, sex and size; extrinsic factors include rearing and testing temperature, humidity, food, density and illumination. These factors are dealt with separately for the three groups of insecticides—stomach poisons, contact poisons and fumigants—and also for repellents. The physical and chemical properties of the insecticides themselves in their various formulations and as applied to different surfaces are also important factors to be standardized.

Testing techniques employing stomach poisons fall into three sections; poisons in powder form, liquid stomach poisons and systemic insecticides. Numerous techniques involving such insects as leaf-feeders, muscid larvae and textile pests are described and commented on.

Contact insecticides are dealt with in five different chapters. First, methods using these insecticides in powder form are discussed and then techniques involving immersion of the insects in solutions, emulsions and suspensions. Immersion methods include mosquito larvicide testing, and also details of test techniques for the detection of resistance in mosquito larvae, now being developed as an adjunct to the adult testing technique already referred to. Laboratory spraying apparatus both for the production of aerosols and for surface spraying are reviewed in detail as is also the apparatus for topical application and injection of individual insects. The exposure of insects on residual films of contact insecticides is the basis of the Busvine and Nash susceptibility test [this *Bulletin*, 1953,

v. 50, 1176] and the different methods of applying these films and exposing the insects to them are described.

Separate chapters are devoted to fumigants and repellents and the book ends with a discussion on the all-important subject of toxicological statistics, a thorough understanding of which is essential for the correct interpretation of results. A useful survey of opinion on the utility of mixtures of insecticides for the prevention of resistance is included here.

Based on a very large bibliography, this book will undoubtedly take its place as a standard reference book in all laboratories concerned with insecticides. Although no index is included, the subject-matter is clearly classified at the beginning and little difficulty should be experienced in locating particular aspects. *G. Davidson*

GELFAND, Michael [O.B.E., M.D., F.R.C.P., D.P.H., D.M.R.]. **The Sick African. A Clinical Study.** 3rd Edition. 866 pp., 164 figs. 1957. Wynberg. Johannesburg. Cape Town: Juta & Co., Ltd., P.O. Box 1010. [77s./6d.]

The 1st edition [this *Bulletin*, 1945, v. 42, 78] contained 373 pages, the 2nd edition [*ibid.*, 1948, v. 45, 551] 699, the present 866. Newcomers to medical practice in Africa are quickly impressed not only with the presence of tropical diseases but with the differing manifestations of cosmopolitan diseases. In this book the reader can feel that he is accompanying an experienced physician around his wards and listening with benefit to teaching based on accurate clinical observation.

The preface to the 1st edition clearly defines "the African" as the "aboriginal of Africa". In the present edition the author seems to have widened its meaning and the book would now be better entitled "The Practice of Medicine in Africa". In places, particularly where diseases rare in Africans are being described, it is difficult to know whether the author is basing his account on observations made on Europeans or Africans. Again repeated references are made to tabes dorsalis and sprue although it is correctly stated that few, if any, cases have been confirmed in Africans. The author appreciates that much of the medical work in the present and future must be performed by Africans, yet the phraseology in this book, particularly in references to "the Native" may make it unattractive to African medical students. Methods of examination of a patient cannot be learned from a book, although a teacher, or a student revising, may find chapter 2 helpful. However, some of the statements such as the "lungs should be inspected, palpated . . ." need modification, and clinical methods and ancillary aids (which may not be available) are intermingled.

Where the author is describing conditions which are prevalent in Rhodesia the accounts are very readable and helpful—the sections on onyalai, tropical phlebitis, malignant disease and heart disease, are

particularly good. Schistosomiasis looms large in the text and the general manifestations are considered to be more important factors in chronic ill-health than is commonly appreciated. The author supports this view by claiming that such patients improve when treated with antimony.

Where he is describing diseases which are not common in Rhodesia he quotes freely from other authors and the views quoted are somewhat contradictory and confusing and frequently out of date.

In attempts to deal comprehensively with each subject there is much repetition which could be avoided by cross-references. For example, the causes of diarrhoea and dysentery are given on pp. 349–353 and again on pp. 714–716. [It is strange to find cantharidin poisoning as the third cause in the first account and not mentioned in the second.]

Chemotherapy tends to be unduly conservative. Arsenicals are still included among the recommendations for yaws, syphilis. relapsing fever, anthrax and chronic malaria: santonin for ascariasis, while carbon tetrachloride and even stilbamidine are still listed. Drugs are not consistently referred to by their pharmaceutical names and where trade names are used these are not indicated as such or alternative names given. The nomenclature of diseases is not fully consistent, *e.g.*, the author favours "bilharziasis" but in places uses "schistosomiasis". The convention of recording the names of parasites in italics, with a capital for the initial letter of the genus only, is inconstantly observed.

Some statements require correction or modification. The following are examples. P. 126, death from (hookworm) anaemia is rare. P. 154, "it is still essential to remove lepers from kraals and to isolate them". P. 155, whether yaws is a distinct disease entity different from syphilis is not certain. P. 174, optic atrophy is a common complication of relapsing fever. P. 210, *A.* [*D.*] *perstans* is rarely reported in Europeans. Pp. 259–260, the vesicle of chickenpox is generally multilocular and contacts should be isolated for 21–23 days. [Is this to be recommended for Africans?] P. 288, witkop is considered to be a manifestation of congenital syphilis. [It has been shown to be due to favus.] P. 383, the history of kwashiorkor and the origin of the word need revision [*ibid.*, 1955, v. 52, 496].

No mention is made of intestinal anthrax and insufficient appreciation is shown of what can be achieved in the treatment of tuberculosis.

The text is marred by a number of typographical errors and carbarsone still appears as carbasone in spite of the comment of the reviewer of the 2nd edition [*ibid.*, 1948, v. 45, 551]. There is a lengthy bibliography but few of the articles are recent.

In spite of these criticisms there is much to be applauded in this well illustrated book and anyone interested in medical practice in Africa would be well advised to secure a copy. The reviewer thinks, however, that the author would have done better to have limited his field to Rhodesia or to have collaborated with others who practise in other parts of Africa.

F. J. Wright

THALHAMMER, O. Die Toxoplasmose bei Mensch und Tier. [**Toxoplasmosis in Man and Animals**] pp. viii + 307, 42 figs. 1957. Vienna I: Wilhelm Maudrich, Franz-Josefs-Kai 23. [$13.20.]

This book consists of an introduction and seven chapters.

The first deals with the history of research on toxoplasmosis and also indicates some of the problems still unsolved.

The second describes *Toxoplasma*, not only as seen by more usual methods but also in photographs of ultra-thin sections under the electron microscope. Consideration is given to the identification of toxoplasms in material from man and animals. Strains differ in pathogenicity, and infection with one of low virulence affords protection against a more virulent strain.

In the third chapter diagnosis is considered. None of the available laboratory methods can do more than show the presence of *Toxoplasma* infection. They cannot prove it is the cause of a particular illness. The likelihood of this depends on the clinical condition. Isolation of the parasite by inoculation of material into mice or hamsters is the best method of proving infection, and it is helpful to give the animals cortisone for 3 to 5 days. Fertile eggs and tissue cultures can be used but with less chance of success. When isolation of the parasite is impossible or fails, diagnosis will have to rest on the demonstration of antibodies. The Sabin-Feldman (dye) test is described and some difficulties are discussed. Electron microscopy helps to explain it. Toxoplasms that have been acted on by antibody and accessory factor lose their internal structure; hence their ability to absorb the dye. For the complement-fixation test the author finds that antigen made from mouse peritoneal exudate, being richer in toxoplasms, is better than antigen made from egg membrane. A description of the author's technique is given. A stable dried antigen which can be distributed is described; this should make it possible for any laboratory to carry out a serological test for toxoplasmosis. All active clinical toxoplasmosis and 74% of latent symptomless infection can be detected by the complement-fixation test. The statement that it becomes positive later and negative earlier than the Sabin-Feldman test derives from the weakness of many antigens. Laboratories should carry out two tests; the complement-fixation test and either the Sabin-Feldman test or the skin test. The skin test gives a 96·4% correlation with the Sabin-Feldman test at a dilution of 1 in 4 or more, but is unreliable in infants under the age of 2 years and in persons with senile atrophy of the skin. It has the disadvantage of being only qualitative. Demonstration of toxoplasms in tissue sections or smears is not easy, nor can they be identified with certainty except in the pseudocyst form.

Chapter four deals with the interpretation of the results of the tests. Arguments are given for and against their specificity. The author believes that they are specific. Any titre, however low, indicates that there has been infection. The extent of this in a community cannot be

correctly determined unless low titres are taken into consideration. Moreover titres are low in the early stages of active infection. It is not, therefore, possible to establish a " threshold ". The interpretation of the results of antibody tests depends on a knowledge of the titres and their rising frequency at different ages in normal persons in any particular area. Graphs and tables are presented showing the results in different countries and those for Vienna are given in detail. Of practical value is a knowledge of what may be considered low, medium and high titres in the Sabin-Feldman test. In Vienna these are 1 in 4 to 1 in 16, 1 in 64 and 1 in 256 or more. Only 1·8% of positive tests reach the last figure. A rise in titre is valuable. During the first to third week after infection antibodies are absent or low, in the third to fourth week there is a rapid rise above normal levels, during the following weeks or months the antibodies remain at this high level, then they gradually fall but remain at a low level for years, perhaps for life. The skin test becomes positive later than the Sabin-Feldman test. This discrepancy indicates recent infection.

The fifth chapter describes the clinical manifestations of toxoplasmosis. Infection, being blood-borne, may attack any organ. It need not, however, produce severe disturbance. If only a few toxoplasms infect or if the local and general defence is good the parasite takes the form of a pseudocyst and does little or no damage. The only real difference between the congenital and the acquired disease is that cerebral calcification and jaundice have been found only in the former. The manifestations of congenital toxoplasmosis are very varied. In one form there is fever, enlargement of the liver and spleen, jaundice, pneumonia, myocarditis and encephalitis or any combination of these: in another, any combination of encephalitis, intracerebral calcification, chorioretinitis and hydrocephalus. Older infants and young children may show arrested development, convulsions and hydrocephalus. At school age visual defects (chorioretinitis), epileptic attacks or debility may be noted. It is very likely that healing takes place *in utero*. If infection is severe and late in foetal life, then, at birth, brain damage will be overshadowed by the other manifestations. If it is less severe or earlier other lesions will have healed and encephalitis be prominent.

Next the author discusses the possibility of other forms of cerebral damage being due to toxoplasmosis. He finds that a statistically greater number of children with epilepsy and mental retardation have antibodies to *Toxoplasma* than have controls.

There follows a discussion on endocrine disturbances associated with congenital toxoplasmosis. These may result from encephalitis or from damage caused to endocrine organs, for toxoplasms have been found in the pituitary, adrenal, pancreas, thyroid, testis, ovary and thymus. Toxoplasmosis plays no part in the production of congenital malformations. Statistical evidence does not prove *Toxoplasma* to be a cause of abortion but this is possible for it has been isolated from an aborted ovum. It may be a cause of hydatidiform mole. For congenital infection to occur it

would seem necessary for the mother to have active infection and parasitaemia after the fifth month of pregnancy. The re-activation of a pre-existing infection seems unlikely. No case is recorded of a woman having toxoplasmic babies in two pregnancies. It has been shown that mice can be infected by their mother's milk; this may rarely occur in human babies. When *Toxoplasma* infection is so frequent it may seem strange that congenital toxoplasmosis is not more common. By ingenious calculation the author claims to show that in Vienna both the estimated and observed incidence of congenital toxoplasmosis is around 6 per 1,000 births. This refers to all forms including minor manifestations. He quotes VIVELL (*Arztl. Forschung*, 1953, v. 7, 326) who put the incidence of typical congenital toxoplasmosis at 1 per 1,000 and HOLMDAHL at 1–2 per 10,000 (*J. Obstet. & Gynaecol. Brit. Empire*, 1953, v. 60, 765). The differential diagnosis of congenital toxoplasmosis can be easy, as in cases with the classical triad of signs. It can also be very difficult, particularly so in generalized disease with jaundice and enlargement of liver and spleen. Haemolytic disease of the newborn is the commonest cause of this but toxoplasmosis should be borne in mind.

Acquired toxoplasmosis is next discussed. Infection is most commonly asymptomatic. Mothers of babies with congenital toxoplasmosis are rarely ill and toxoplasms have been found in persons who died from other causes. 10 such cases are listed. The first reported cases of acquired toxoplasmosis were fatal. The gap between these and asymptomatic infections is now being filled by reports of illnesses varying greatly in severity. A table is given showing the main signs, and illustrative cases are quoted, beginning with typhus-like cases in which encephalitis preceded death and ending with lymphadenopathies, which are sometimes very mild. Statistical evidence points to acquired toxoplasmosis being a cause of chorioretinitis and this is supported by a few proved human cases and experimental work. There are also a few reported cases of conjunctivitis, optic neuritis and one of iridocyclitis. Recurrent toxoplasmosis is possible but not proved. There are no proved cases of chronic clinically manifest toxoplasmosis.

The sources and ways of postnatal infection are discussed. These must be very many, but so far the only known way is by laboratory infection. 22 instances of this are given [a few questionable]. Some of them resulted from a needle prick, others from a splash in the eye. In the majority the mode of infection is not known but oral infection while pipetting is suspected. Very frequently there is a history of animal contact, not infrequently with a sick animal. Infection through the mucous membrane of nose or throat is possible, as is infection through eating uncooked or partially cooked meat containing pseudocysts.

Chapter six deals with toxoplasmosis in animals. All mammals and probably all birds can be infected. The extent of spontaneous infection in many species of animals is given. Rarely does it lead to obvious illness. Animals vary greatly in susceptibility. The young are more

susceptible and in rats and cattle the disease has been seen only in young animals. Even in relatively resistant animals (*e.g.*, dogs) epizootics sometimes occur. Diagnosis is made as in man but it should be remembered that some animals (*e.g.*, hens and cattle) do not produce antibodies in high titre.

In chapter seven the results of therapy in experimental animals and in a few human cases are surveyed. So far sulphonamides and daraprim (pyrimethamine) appear to be the most effective agents and to potentiate each other. It is important that treatment should be started early. In relapses (*e.g.*, chorioretinitis) longer and more intensive treatment is needed. Most congenital cases have already suffered irreparable damage. The aim should be to prevent congenital infection. In order to detect which pregnant women require treatment the author recommends that serological tests should be carried out in the third and eighth months of pregnancy. If the first and second tests are both negative there is no need for treatment. If both first and second tests are positive to a low or medium titre the woman has had a latent infection in the past and need not be treated. If, however, the second test shows a high titre her infection is recent and she should be treated. The remaining possibility is that the first test is strongly positive. This indicates fresh infection a few weeks before. Infection of the foetus is not likely but it would be as well to give treatment. Finally there is a short account of disinfectants used to kill toxoplasms.

This book contains the most complete account of toxoplasmosis yet written. Very little of the work done to the time of publication has been overlooked and there are over 1,000 references. The photographs are very good and the whole production of a high standard.

The reviewer has only one criticism of the book; it would have been still better had it been shorter. There are numerous repetitions and much might have been more concisely expressed. *C. P. Beattie*

London School of Hygiene and Tropical Medicine. **Memoir No. 12. Studies on the Exo-Erythrocytic Cycle in the Genus** *Plasmodium* [Bray, R. S. (B.Sc., Ph.D.)]. pp. vii + 192, 24 figs. 1957. London: H. K. Lewis & Co. Ltd. 136 Gower Street, W.C.1. [42s.]

The exo-erythrocytic stages of avian malaria parasites were largely discovered before, and those of mammalian parasites after, the Second World War, but no general account of the subject in detail had appeared until the publication of this monograph. It is therefore a most welcome addition to the literature; not only does it provide an extensive historical survey and a formal description of the morphology and biology of the tissue stages of malaria parasites, but it contains accounts of work done by the author himself which are not available elsewhere. The book is illustrated by 20 figures, drawn in Indian ink, showing the main characters of the exo-erythrocytic forms; this method of reproduction gives a clear picture of nuclear structure but does not bring the parasite to

life, which colour alone can do. This is really the only criticism of an invaluable book; some people may even prefer the careful camera lucida drawings to the more lurid pictures, with which we and our American colleagues habitually illustrate our papers.

Two introductory chapters are devoted to classification and definitions; there follows a useful historical chapter dealing with (a) early work on the exo-erythrocytic cycle, the significance of which was not realized at the time, (b) the exo-erythrocytic cycle of avian plasmodia, as known up to 1943, and (c) the cycle of mammalian plasmodia, as revealed up to 1947. The next two chapters then describe in detail the present-day knowledge regarding these two groups.

12 avian species and 4 lizard species are described, first in regard to their pre-erythrocytic schizogony (known only in half of the avian and in none of the lizard forms), and second the exo-erythrocytic. The tissue cycles of *Plasmodium gallinaceum* are given in considerable detail, which includes the abnormal behaviour of the parasite in various artificial circumstances; the remaining parasites are treated more briefly. The biochemistry of these stages is then discussed both in connexion with metabolism and as applied to chemotherapy. The progress of infections of avian malaria is discussed in relation to relapses and immunity, and a short note on tissue culture is included. The chapter ends with a brief description of exo-erythrocytic schizogony of the related genera, *Leucocytozoon* and *Haemoproteus*.

The tissue cycle of the mammalian parasites is considered in much the same way as the avian, but contains many new observations of the author himself, particularly in relation to *P. cynomolgi*. The cycle of this parasite is given in the greatest detail, first a summary of past work and second a description of the author's experiments. It is impossible in a review to mention more than a few of the more important observations: the frequent presence of retarded forms and the connexion between them and the relapse phenomenon; early pre-erythrocytic schizonts (up to 3 days); intravenous inoculation of sporozoites is 55 times as effective as inoculation by bite in producing pre-erythrocytic schizonts in the liver; there is a reasonable correlation between the numbers of sporozoites introduced and the numbers of pre-erythrocytic schizonts found subsequently in the liver; the use of controls which give clear proof that the liver forms are not artefacts. The tissue stages of *P. inui*, *P. vivax*, *P. ovale* and *P. falciparum* are then briefly described, and the doubtful forms in *P. knowlesi* (Edeson's merocysts) and *P. berghei* are also mentioned. Biochemical work on the mammalian parasite, including original observations of the author, is considered in much the same way as in the description of the avian parasites; an experiment in which the monkeys' livers were deprived of glycogen showed, unexpectedly, that in such conditions the parenchyma cells were more, instead of less, susceptible to the pre-erythrocytic schizonts, perhaps because the lack of glycogen makes the cells more penetrable by the sporozoites.

Probably the full explanation of the relapse phenomenon is the most important lacuna in our knowledge of malaria today; the author discusses the various theories at length, with particular reference to *P. vivax*, and suggests, with some lack of conviction, that a normal basic haemotropic/histiotropic merozoite formation ratio exists for each species of parasite, which is altered both by drugs and immunity. This chapter, like the former, ends with a brief description of exo-erythrocytic schizogony in related genera (*Hepatocystis*, *Polychromophilus* and *Nycteria*).

The last chapter on taxonomy and specific classification almost serves as the author's conclusions. He starts it on the basis that it is better to increase genera and decrease species rather than *vice versa*; such a policy leads to less confusion, and with well differentiated characteristics available, it would be wasteful not to use them for the formation of genera if not families. He redefines the genus *Plasmodium* as "a parasitic protozoan which reproduces sexually and by sporogony in an anopheline mosquito and asexually by schizogony in two cycles, one, producing pigment, in non-nucleated red blood cells, and the other in parenchyma cells of the liver, producing considerably more than 1,000 merozoites". The genus *Haemamoeba* is redefined as "a parasitic protozoan which reproduces sexually and by sporogony in the family Culicidae, and asexually by schizogony in two cycles, one producing pigment in nucleated red blood cells, the other in endothelial and haemopoietic cells producing considerably less than 1,000 merozoites".

The phylogeny of parasites belonging to the Haemosporidia is discussed and Bray suggests that the adeleid haemogregarines were the ancestors of the group. He thinks that two lines have developed—one from *Karyolysus*, from which came those haemoproteids (and eventually *Haemamoeba*) which undergo schizogony in the endothelial cells of the lung, etc., the other from *Hepatozoön* from which came those haemoproteids (and eventually *Plasmodium*) which develop in the parenchyma of the liver. The chief criticism of this theory lies in the fact that the adeleid haemogregarines are usually placed in a different order from those of the malaria parasites on the basic details of syzygy. The subject is also dealt with in the previous chapter, where the general similarity of morphology and mode of growth throughout the sporogonic and schizogonic stages of various families in the Coccidiomorpha is emphasized.

The check list on page 155 shows the present state of knowledge of the biology of malaria and related parasites, and includes 49 species; a useful table contrasts the behaviour of avian and mammalian forms. The bibliography is extensive, and is equally valuable for up-to-date and historical references.

The book is written in a vivid personal style which makes for lively reading; the author does not avoid controversial issues and some of his views will no doubt be challenged by American and Continental workers as well as by his past colleagues! *P. C. C. Garnham*

Printed in Great Britain under the authority of Her Majesty's Stationery Office
by The Eastern Press, Ltd., London and Reading.

(2620) Wt. P8511/508 5/58 E. P. Ltd. Gp. 566.